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PC HOW-TO GUIDE

SUMMER 2013

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inside

HOW TO 2013

IN DEPTH

6 HACK YOUR HARDWARE

20 PC BUILDERS BIBLE

32 DATA RECOVERY SOFTWARE

40 TRACK A LAPTOP

48 CHEAP COMPUTING

60 FIX ANY PC PROBLEM

HOW-TO

72 IMPROVE WI-FI

74 SIDELOAD ANDROID APPS

75 INSTALL A RAM DISK

76 USE PROCESS EXPLORER

80 INSTALL WINDOWS 8 FROM A USB KEY

BUILD IT

82 CRYSIS 3 PC

86 WEE GTX TITAN BOX

92 INTEL NUC PC

96 THE LIST

FEATURES

6
HACK YOUR HARDWARE
Unleash your hardware's hidden power with these handy hacks.

20
PC BUILDER'S BIBLE
These expert tips will help with your next build.

32
DATA RECOVERY SOFTWARE
Eight of the top data recovery packages tested.

40
TRACK A LOST LAPTOP
The best software to hunt down a lost laptop.

48
CHEAP COMPUTING
Save money without sacrificing performance with our killer guide.

60
FIX ANY PC PROBLEM
Troubleshoot and solve the most common PC ailments.

MAXIMUM PC

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Josh
Norem

BUILDING IS HALF THE BATTLE

IF YOU THOUGHT all you had to do to become a PC power user was build a system with your own bare hands, think again. Contrary to what you may have assumed, building a customized weapon of benchmark destruction is merely the first step on a long journey of total PC mastery. Once you build the beast, it's time to tame it.

You see, a Maximum PC doesn't earn that title by simply having all the right parts inside. Oh no, in order to mold your rig into a truly one-of-a-kind customized life partner, you will need to show it who's boss by diving in and tweaking every last nook and cranny of not just your hardware but your software as well. After all, anyone can buy or build a PC, so just having a powerful rig does not make one able to claim the mantle of "power user." No, that distinction requires your ability to subjugate your rig into submission.

Just as we've helped you select all the parts of your Dream PC (or at least, the PC you can afford right now), we're here to hold your shielded-from-static wrist as we walk you through a wide range of PC projects designed to not just give you total control over your PC environment, but to help you squeeze every last jiggawatt of performance out of it as well. Once you've completed the tasks outlined in this magazine, your chest will swell with pride at having exerted your will over an unruly mess of hardware and software, your network, and your operating system.

Before you dive in, be aware that most of the projects you'll find in this tome are not simply guides on how to set up a piece of hardware or to install a firewall or something pedestrian like that. Oh no, we are going to go much further than that, all with the goal of helping you achieve maximum performance from your PC. Whether it's boosting your Wi-Fi signal, examining your PC for performance bottlenecks (and eradicating them), or adding a RAM disk to your rig, we'll walk you through a wide variety of projects that will help you juice your rig like a major league baseball player. In addition to how-to guides that give you step-by-step instructions, we'll also be offering easy-to-digest guides on how to perform PC-related tasks ranging from saving money on hardware and software, to general guides on PC repair, troubleshooting, and system monitoring. We'll wrap it all up by showing you how to build three very specialized PCs, should you want to embark on a PC-building project.

Whether you're a PC-building veteran, a curious tinkerer, or a complete rookie, we're sure you'll find plenty of useful tips and tricks in this magazine that will help you take your PC to the next level and beyond. Happy reading!

Josh Norem is a Senior Editor at Maximum PC magazine.

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HACK YOUR HARDWARE

By Marco Chiappetta

11 DIY PROJECTS TO UNLEASH YOUR GEAR'S HIDDEN POWER—FOR FREE!

THERE ARE SEVERAL practices that distinguish true power users from common folk. System building is one. Component benchmarking certainly applies. As does religious parts swapping. And then, of course, there's hardware hacking. Hacking, more than anything else, exemplifies our ongoing quest for more—more performance, more functionality, more power—because we're wringing this extra goodness from gear we already own, using crafty methods and occasionally pushing the bounds of practicality in the process; sometimes just for the heck (or should we say *hack*?) of it.

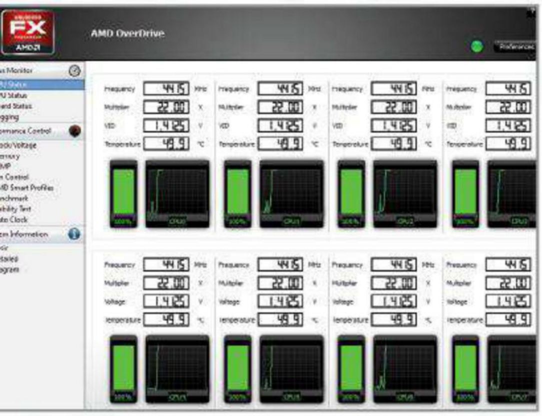
We know that GPUs and CPUs often have features disabled or dialed back in order to fit a price point. We'll show you some nifty ways to access their hidden capabilities, as well as some fixes for inherent flaws. We also know that our gear can be made to do more than it was intended to with the help of third-party software, as you'll discover in our webcam and Roku projects. And if you want to make your smartphone smarter, increase your Wi-Fi router's range, or RAID your SSDs, we'll turn you on to those tricks, too.

So what are you waiting for? Let's get hacking!

OVERCLOCK AMD BULLDOZER

After years of AMD hyping the Bulldozer microarchitecture for its supposed efficiencies, the initial batch of Bulldozer-based AMD FX Series processors arrived with a resounding thud due to disappointing performance and relatively high power consumption. But amid all the fervor following the launch, many enthusiasts seem to have missed the fact that AMD's then-flagship FX-8150 was technically the fastest desktop processor the company had released to date. Of course, being the fastest processor in AMD's line-up at the time didn't mean there wasn't some frequency headroom left under the hood. It turns out that the Bulldozer-based AMD FX-8150 is a pretty decent overclocker.

We all saw the reports of AMD's Bulldozer breaking overclocking records and earning a place in the Guinness World Records. But those overclocks were performed with liquid-helium cooling, binned chips, extreme voltages, and only a single Bulldozer module (two cores) enabled. Overclocking a retail-ready processor with all of its cores enabled using more traditional cooling methods is a different story altogether. Luckily, not much has changed with Bulldozer in the overclocking department; the tried and true methods of tweaking multipliers, voltages, and the HyperTransport clock that worked with the Phenom II carry over to Bulldozer, as well.



Frequency 4415 MHz
Multiplier 22.00 x
VID 1.4125 V
Temperature 49.9 °C

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Frequency 4415 MHz
Multiplier 22.00 x
Voltage 1.4125 V
Temperature 49.9 °C

Frequency 4415
Multiplier 22.00
Voltage 1.4125
Temperature 49.9

The AMD OverDrive real-time overclocking and system-monitoring utility is a great tool for tweaking the performance of a Bulldozer-based system when used in conjunction with the right motherboard.

We set out to see what kind of overclocks were possible with an AMD FX-8150 using a standard air-cooler and an AMD 990FX-based Asus motherboard. Instead of using the motherboard's UEFI/BISO to overclock, though, we turned to AMD's OverDrive utility, which lets users overclock from within Windows in real-time without having to reboot and waste time constantly restarting a system.

Because FX Series processors are "unlocked," their multipliers can be raised or lowered to increase or decrease the CPU frequency at will. Increasing or decreasing the HT clock has the same effect, and pumping more voltage into a chip will typically allow for higher frequencies, as well, provided it is adequately cooled.

The FX-8150 has a base clock of 3.6GHz, which will dip down to 1.4GHz while idling. When half (or fewer) of its cores are being utilized, the FX-8150 is able to Turbo up to a peak frequency of 4.2GHz. When all of its cores are being fully utilized, the FX-8150 can Turbo up to 3.9GHz. And while all of this is happening, the processor's voltage will fluctuate between approximately .85v and 1.36v. By disabling Turbo, turning the voltage up beyond 1.4v, and cranking up the CPU multiplier with AMD's OverDrive utility, all of the cores on the chip can run at even faster speeds and offer much better overall performance.

AMD FX™
FD8150FRW8KGU
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MADE IN MALAYSIA

How much faster the FX-8150 will run varies from chip to chip, but we found that at 1.4125v, our CPU could reliably hit 4.41GHz (22x multiplier x 200MHz HT clock). At frequencies any higher at that voltage, the test bed was unstable, and pumping upwards of 1.5v into a 32nm chip with air cooling isn't ideal. To hit 4.41GHz, we simply launched OverDrive, chose Advanced mode, disabled Turbo, and moved the CPU multiplier and voltage sliders as necessary. Please note that the CPU settings in your BIOS/UEFI should be set to Auto should you want to experiment with OverDrive.

When running at 4.41GHz, the FX-8150 offered up a Cinebench R11.5 score of 7.31, an increase of 1.3 points, or 21.6 percent, over the stock score of 6.01. And its temperature peaked at only 71 C. That kind of performance boost won't allow the FX-8150 to overtake many of Intel's faster chips, but it's a huge gain nonetheless and one that's easily obtained using the OverDrive software.

AMD CORE UNLOCKING: UNLEASH DORMANT CPU CORES

IN THE EARLY STAGE of a processor architecture's lifetime, it is common for multicore dies with nonfunctional cores to be harvested for use in lower-end products, while fully functional dies end up at the high-end. Over time, however, as manufacturing processes mature and yield increases, there are fewer and fewer dies with nonfunctional elements to harvest. If there is still demand for lower-cost processors, though, in lieu of expending engineering resources designing a new, cheaper-to-produce core, chip makers like AMD will often disable perfectly good cores in an existing CPU design to satiate the market.

Such is the case with a number of chips in AMD's aging Phenom II product line. After years in production, yields are high on quad-core versions of the chip, but there is still a relatively large demand for cheaper, dual- and triple-core Phenom II processors. As such, many of those dual- and triple-core chips have additional cores on-die that are functional, but dormant. Manufacturers of enthusiast class motherboards, however, have devised BIOS/UEFI-level tricks to un-

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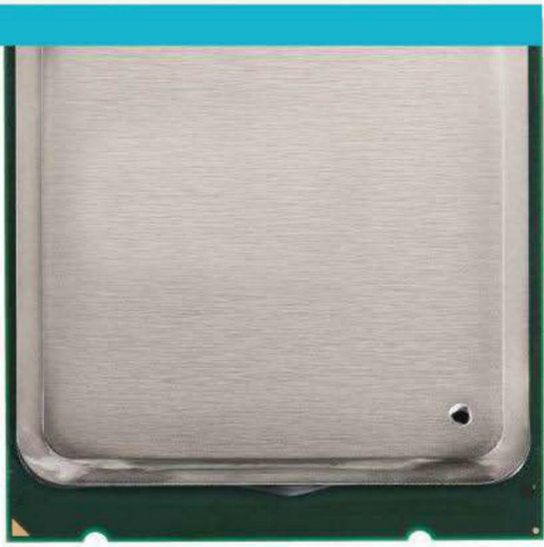
OVERCLOCK INTEL SANDY BRIDGE-E



Intel's Sandy Bridge-E is a beast of a microarchitecture. It takes many of the good things about the already awesome Sandy Bridge and vastly expands upon them. Whereas Sandy Bridge-based processors sport up to four cores, 16 lanes of integrated PCIe 2.0 connectivity, dual-channel memory controllers, and 8MB of shared L3 cache, Sandy Bridge-E features eight cores, 40 lanes of PCIe 3.0-class connectivity, quad-channel memory, and up to 20MB of shared L3. We should point out, though, that current SNB-E based desktop processors have only four or six cores enabled and up to 15MB of shared L3.

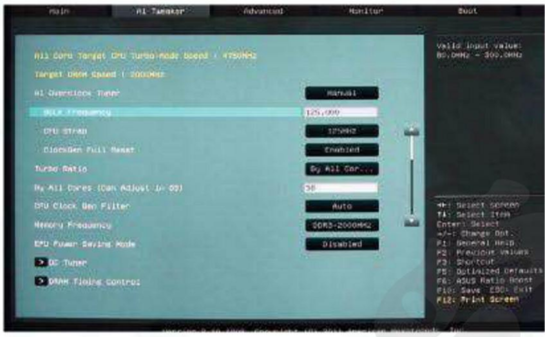
The sum of SNB-E's parts results is that it's still one of the fastest desktop processors Intel has released to date. Of course, there's always some room for improvement with a little overclocking. Unfortunately, SNB-E inherited one of SNB's undesirable traits, as well—a finicky BCLK, or base clock. Like original Sandy Bridge-based parts, Sandy Bridge-E processors offer limited flexibility for overclocking when using BCLK manipulation. Users who want to alter CPU and memory frequencies via the BCLK are limited to just a few MHz in either direction (approximately 3-5MHz). With Sandy Bridge-E, however, two new BCLK multiples (125MHz and 166MHz) are also available that were not with Sandy Bridge, so there is some fun to be had there. Like K-Series SKUs, though, Core i7 Extreme Editions are fully unlocked, meaning CPU, Turbo, and memory clocks can all be adjusted by using different multipliers.

When overclocking SNB-E chips, power and cooling considerations are paramount. Running at its stock 3.3–3.9GHz speeds, the Core i7-3960X is rated for 130W TDP, but power consumption and heat output increase substantially when the chip is overclocked. With that in mind, Intel and its motherboard partners have incorporated options to dynamically increase voltages when necessary and specify peak current thresholds. These new options and SNB-E's more demanding power and heat considerations make the overclocking process somewhat more complex, but if you don't feel like tinkering much and have a good cooler and PSU, playing with voltages and multipliers are all that is necessary to achieve some monster overclocks with SNB-E. We should also point out that although options are available to disable SpeedStep and various C states, overclocking SNB-E only requires finding the right combination of BCLK, voltage, and maximum Turbo frequencies. By altering those options alone and not messing with SpeedStep or C states, the processor can still throttle down while idle to minimize power consumption and temperatures.

To give you some examples, most SNB-E-based processors can achieve 4.5GHz with decent air or liquid cooling. A large percentage of the chips can do 4.6GHz to 4.7GHz with minimal effort, and 4.8GHz should be doable with the right voltage (1.4v to 1.5v) and high-end cooling. 5GHz-plus should also be possible with select chips and more exotic cooling.

We did some overclocking with a Core i7-3960X Extreme Edition processor and Cooler Master Hyper 212 cooler with the excellent UEFI utility on the Asus P9X79 Deluxe motherboard and were able to push our particular chip to 4.75GHz. We achieved that speed using a 125MHz BCLK strap and a peak all-core Turbo multiplier of 38 (125MHz x 38) with a peak voltage of 1.425v. At that speed and voltage, however, we were pushing the limits of the cooler—the processor would approach the 90 C mark after extended periods of sustained load, and at 91 C, SNB-E-based chips will begin to throttle.

With the processor overclocked to 4.75GHz, the Core i7-3960X Extreme Edition's Cinebench 11.5 score jumped from 10.51 (stock frequencies) to 13.99 (overclocked frequency), an increase of 33.1 percent. Not a bad performance boost for simply altering a few settings in our motherboard's UEFI utility.



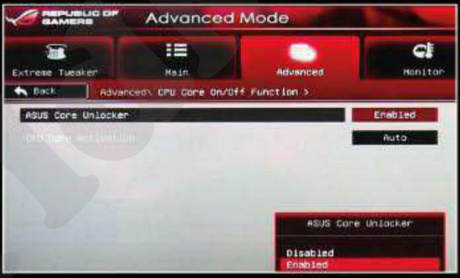
All Core Target CPU Turbo-Mode Speed : 4750MHz
Target DRAM Speed : 2000MHz
Ai Overclock Tuner Manual
BCLK Frequency 125.000
CPU Strap 125MHz
ClockGen Full Reset Enabled
Turbo Ratio By All Cor...
By All Cores (Can Adjust in OS) 38
CPU Clock Gen Filter Auto
Memory Frequency DDR3-2000MHz
CPU Power Saving Mode Disabled
> OC Tuner
> DRAM Timing Control
Valid input value: 80.0MHz - 300.0MHz

The UEFI utility on Asus' P9X79 Deluxe motherboard allowed us to take our Sandy Bridge-E based Core i7-3960X to 4.75GHz by altering only a few options in the Ai Tweaker menu.

lock those cores and turn cheap processors into something much more powerful.

Unlocking cores is very easy, provided you've got the right CPU and motherboard combo. Asus, Gigabyte, MSI, and other motherboard makers all offer Socket AM3/AM3+ boards with core unlocking capabilities (the boards require a SB7x0 or newer south bridge with Advanced Clock Calibration). As for the processors, many Phenom II X2, Phenom II X3, and Athlon II X3 chips are unlockable. Although not guaranteed, processors from newer batches should have no trouble being unlocked. If you've got one of these processors, do a quick search to see if others have had success with it—most likely they have.

To actually perform the unlock requires nothing more than entering the BIOS/UEFI, heading into the Advanced CPU configuration menu and enabling Core Unlocking or ACC (or whatever the motherboard manufacturer has called the setting). Keep in mind, though, should your chip unlock without incident, it may require increased cooling to deal with the additional active cores.



Advanced\ CPU Core On/Off Function >
ASUS Core Unlocker Enabled
[illegible] Auto
ASUS Core Unlocker
Disabled
Enabled

A simple flip of a switch within the Asus CrossHair V Formula motherboard's UEFI can unlock dormant cores on some AMD dual- and triple-core processors, resulting in significant multithreaded performance improvements.

MOD YOUR RADEON HD 6900 GPU'S COOLING

We have had the opportunity to evaluate a number of AMD Radeon HD 6900 series cards since their release. For the most part, the cards have been well-built and stellar overall performers. A small number, however, have suffered from minor cooling-related issues that can have an adverse effect on GPU temperatures. The issues have never caused any instability or major problems to speak of, but remedying them will lower operating temperatures, which in turn can result in a quieter, more overclockable card.

On the backside of reference Radeon HD 6900 series cards, there is a metal retention/spring plate that secures the GPU heatsink in place and applies constant pressure to ensure good contact with the chip. On occasion, that spring plate hasn't been fully tightened or was slightly bent to the point where it wasn't applying optimal pressure. While disassembling cards to fix the issue, we've also found that some Radeon HD 6900 series cards have had way too much thermal paste applied to their GPUs. Ideally, only a small amount of thermal interface material should be used to facilitate heat transfer from a chip to a heatsink; a paper-thin amount is all that is necessary. But on many of the Radeons we've disassembled, there has been so much thermal paste installed that more has oozed out from the sides of the GPU die than is actually necessary in the first place. And having too much thermal paste applied to a chip can actually hinder cooling performance.

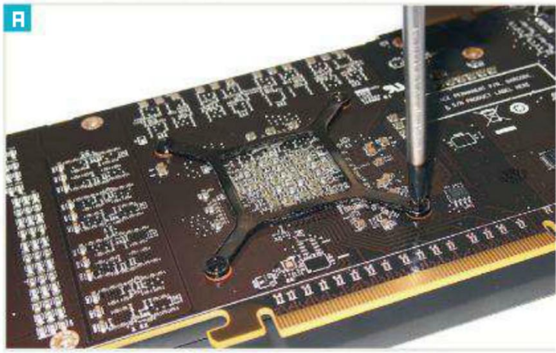
To ensure that an affected Radeon HD 6900 series card is optimally cooled by the stock heatsink, there are a few steps you need to take.

1 **DISASSEMBLE THE CARD** To disassemble a reference Radeon HD 6900 series card, first remove all of the screws on the backside of the PCB that hold the rear stiffening plate in place, and then remove the plate. Then remove the two screws at the top of the case bracket above the MiniDP ports. Next, remove the four screws holding the heatsink's spring plate in place **(image A)**. At this point, gently rock the entire cooler assembly and pull it away from the PCB, being careful not to yank the wires for the fan out of their connector. Once the cooler is loose, unplug the fan connector and set the cooler aside. Be careful not to remove any of the sticky thermal pads on the memory chips.

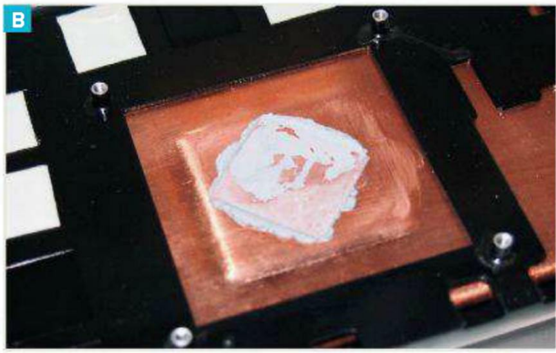
2 **RE-APPLY THERMAL PASTE** With the card disassembled, you'll want to clean off the old thermal paste **(image B)**. Use some isopropyl alcohol (or other cleaner safe for electronic circuits) to carefully clean all of the stock thermal paste from the GPU and heatsink's base. Then apply a very thin layer of quality thermal paste to the GPU; the smallest amount necessary to cover the chip is all that should be used.

3 **RE-ATTACH AND ADEQUATELY TIGHTEN SPRING PLATE** Now the cooler can be reinstalled, but before re-attaching the spring plate make sure it is not bent or deformed in any way, and add a few thin shims to raise it slightly from the PCB and increase the spring pressure. Keep the shims very thin so as not to damage the GPU—we cut up an old rewards card from the supermarket. Stick the shims to the rubber pads on the underside of the spring plate **(image C)** and then put it in place and tighten the screws in a crisscross pattern. Then reinstall the backplate and you're ready to test.

A



B



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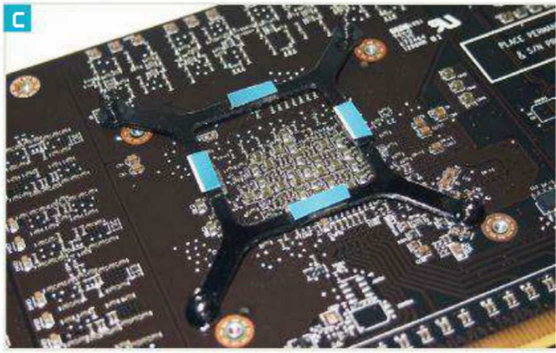
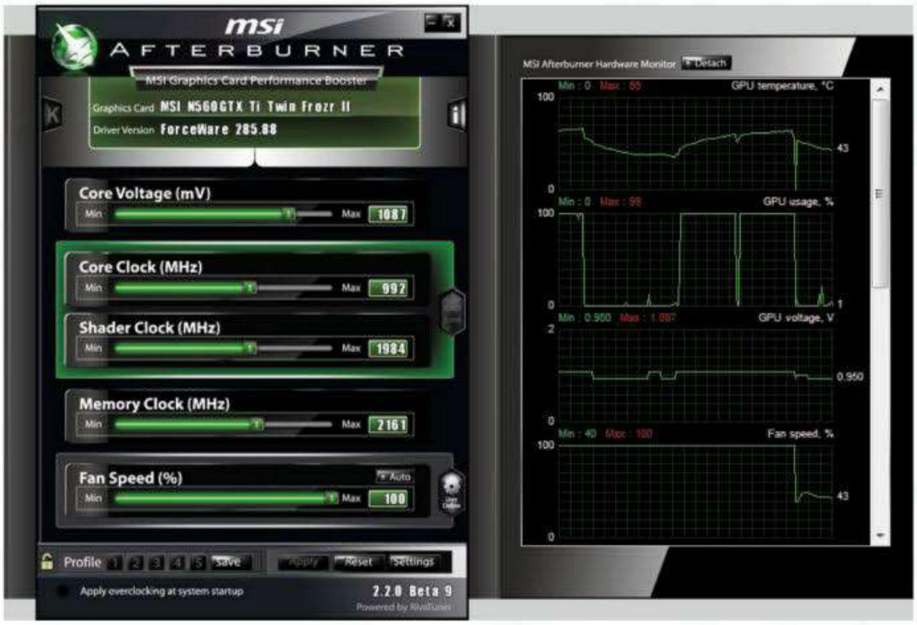


The cooling on our project card was definitely improved. Before touching it, the GPU on our 6970 idled at 44 C and peaked at about 82 C. After the mod, the GPU's idle temp remained steady at 41 C. Peak temps still hit 82 C because the cooler is throttled based on load, but it took somewhat longer to hit the peak, and the card seemed to cool down faster, too.

OVERCLOCK A GEFORCE GTX 560 TI


MSI's Afterburner GPU monitoring and performance-tuning utility can be used to tweak and overclock numerous graphics cards, not just those built by MSI.

Graphics Card MSI N560GTX Ti Twin Frozr II
Driver Version ForceWare 285.88
Core Voltage (mV) 1087
Core Clock (MHz) 992
Shader Clock (MHz) 1984
Memory Clock (MHz) 2161
Fan Speed (%) 100

Nvidia's GeForce GTX 560 Ti, which is based on the company's mainstream GF114 GPU, has proven to be quite a capable graphics card in its price segment. To prevent the card from being too fast and potentially encroaching on the more expensive GeForce GTX 570's territory, however, Nvidia had to delicately balance the 560 Ti's features and performance. The GeForce GTX 570 is powered by a pared-down version of the much more expensive GF110 GPU—to cannibalize its sales would be bad for Nvidia and its board partners, indeed.

With the right tools and a bit of experimenting, it's easily possible to significantly boost the performance of the more affordable GeForce GTX 560 Ti. The MSI Afterburner GPU tuning utility, for example, gives users the ability to not only overclock their GeForce GTX 560 Ti cards (and many other graphics cards, as well), but also alter fan speeds and GPU voltages for even more extreme overclocks.

To illustrate just how much performance is left under the GeForce GTX 560 Ti's hood, we grabbed MSI's already factory-overclocked GeForce GTX 560 Ti Twin Frozr II card and did some tweaking with Afterburner. The first steps in the process are obviously downloading and installing Afterburner. We recommend downloading the latest beta build available at bit.ly/3f5il3 to ensure the broadest compatibility. It wasn't until Afterburner v2.2.0 beta 9 that the 560 Ti was even supported, so if you've got a newer graphics card, using the latest beta is the way to go.

After downloading and installing Afterburner, launch it. A simple menu with a few sliders and hardware monitoring information will open. You could begin overclocking right away, but there are some hidden options that you need to enable in order to unlock the full potential of the app. At the lower corner of the main window, click the Settings button. A new window will open with a number of options available; tick the Unlock Voltage Control and Unlock Voltage Monitoring options and then click OK. Then close and re-open Afterburner and the voltage monitor and voltage control sliders should be available.

Our particular MSI GeForce GTX 560 Ti Twin Frozr II started with a core voltage of 1000mV, or 1v (although it was reported at .95v in the voltage monitor), an 880MHz GPU clock with 1,760MHz shaders and 2,100MHz GDDR5 memory. (The actual memory clock was 1,050MHz with an effective data rate of 4.2Gb/s. Afterburner reports DDR speeds.) Like a CPU, pumping more voltage into a GPU should allow for higher frequencies—within reason—provided the GPU has adequate cooling. Without modding a card's cooler, however, cranking up the voltage beyond about 5-9 percent isn't advisable. The Twin Frozr II cooler from MSI is fairly capable, though, and the card has a robust voltage regulator module, so we were confident we could push our particular card much further than stock.

Without tweaking our card's GPU core voltage, its GPU could hit 940MHz with decent stability. Increasing the GPU's core voltage to 1.087v, however, allowed us to push the GPU all the way up to 992MHz, an increase of 112MHz (12.7 percent) over stock and 170MHz (20.6 percent) over Nvidia's reference spec for the 560 Ti. Just for giggles, we also increased the memory clock to 2,161MHz, but didn't have much success beyond that number. The fan speed was maxed out to ensure the lowest possible temps.

Our tweaking was well worth the effort. The stock MSI 560 Ti Twin Frozr II offered up 25fps and a score of 629 in the Unigine Heaven 2.5 benchmark and 32.2fps in Alien vs. Predator.* At its overclocked frequencies, though, the card managed 26.9fps and a score of 681 in Unigine Heaven and 34.6fps in AvP, increases of 8.2 percent and 7.5 percent, respectively. Not bad for doing little more than downloading a free utility and turning a few knobs.

> “ OVERCLOCKED, THE CARD SAW AN 8.2 PERCENT IMPROVEMENT IN UNIGINE HEAVEN

* Benchmarks were run at 1920x1200 with 4xAA and maximum tessellation enabled.

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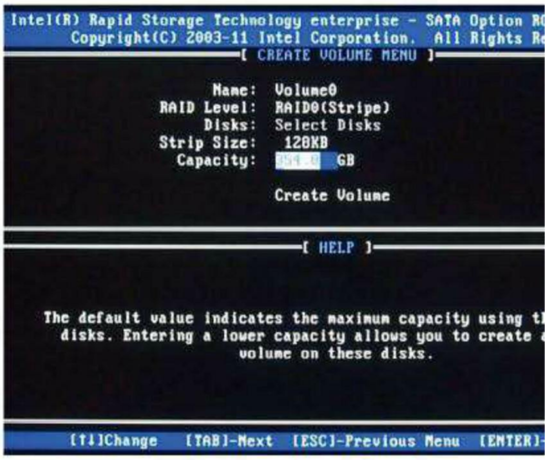


```
Intel(R) Rapid Storage Technology enterprise - SATA Option R
      Copyright(C) 2003-11 Intel Corporation.  All Rights R
═══════════════════════[ CREATE VOLUME MENU ]═══════════════

                  Name:  Volume0
            RAID Level:  RAID0(Stripe)
                 Disks:  Select Disks
            Strip Size:   128KB
              Capacity:  [illegible] GB

                         Create Volume

═══════════════════════════[ HELP ]═════════════════════════

  The default value indicates the maximum capacity using t
    disks. Entering a lower capacity allows you to create
                   volume on these disks.

    [↑↓]Change   [TAB]-Next  [ESC]-Previous Menu  [ENTER]-
```

Configuring RAID on an Intel-based motherboard requires little more than entering the option ROM and working through some simple menus. AMD, Marvell, and other RAID controllers can be configured in a similar fashion, as well.

Solid-state drives are hot commodities for enthusiasts looking to squeeze every bit of performance from their systems. While even a single, midrange solid-state drive is a huge upgrade over a standard hard drive, RAID-ing two (or more) SSDs can result in truly extreme performance. A pair of modern SSDs running in RAID 0, for example, can silently offer upward of 1GB/s of read bandwidth, with similar writes and nearly nonexistent access latency. That's something no array of hard drives could ever muster.

Configuring a group of solid-state drives in RAID is no different than doing the same with standard hard drives. We used an Intel X79 Express-based motherboard from Asus for this endeavor, but the process is similar for a wide range of boards and chipsets.

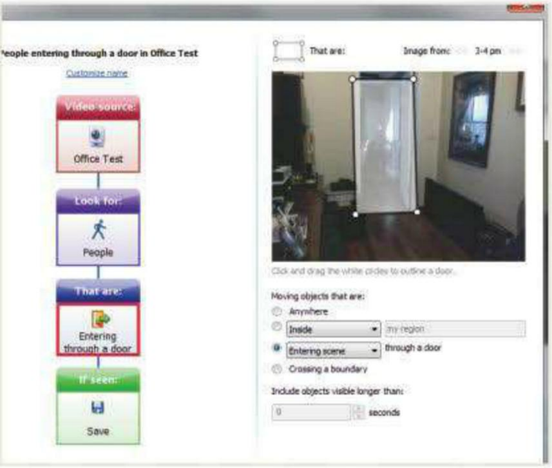
With the SSDs connected to the RAID-capable ports on your motherboard (or RAID controller card), power up the system and enter its BIOS or UEFI. Then head into the advanced configuration or integrated peripherals menu and find the SATA configuration option. Once there, set the SATA ports for RAID mode, then save the changes and exit the BIOS / UEFI.

On the next boot, you should see a prompt at some point after the POST in which you can enter the RAID configuration menu / option ROM (on our Intel-based system, we had to press Ctrl+I). Enter the option ROM and you'll see a handful of menu items. First you'll have to select the drives to include in the array and create the volume. Once created, you'll then have to give the volume a name and choose the RAID mode—we chose RAID 0 for its high-performance characteristics. Then you'll have to choose a stripe size (Intel recommends 128K for RAID 0) and finally set the total capacity of the RAID volume. Save the settings, exit the option ROM, and that's it.

Keep in mind that you'll also need to install the correct drivers for your OS to properly detect the array. And that Trim—an important feature of SSDs that helps maintain long-term performance—is not supported in RAID, but the idle garbage-collection algorithms available in newer SSDs will still work.

USE A WEBCAM AS A SECURITY CAMERA WITH OBJECT RECOGNITION

Boring video conferences and subpar facial recognition may have been the only jobs some webcams were good for, but when paired with the right software, a webcam can be transformed into a powerful security tool.



Moving objects that are:

○ Anywhere

○ Inside ▾ my region

● Entering scene ▾ through a door

○ Crossing a boundary

Include objects visible longer than:

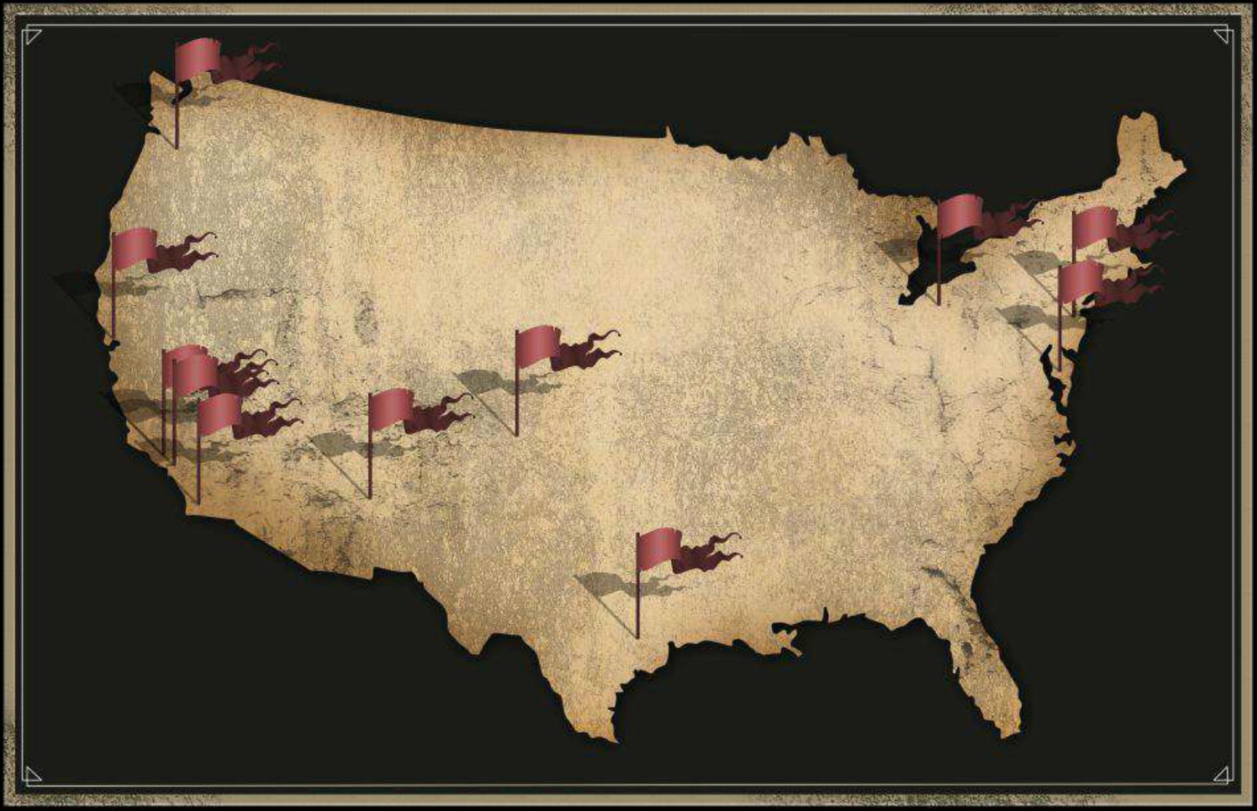
0 seconds

Vitamin D Video can transform a lowly webcam into a powerful security camera with object recognition.

The process is straightforward, too. First, make sure your webcam is connected to your PC or network, its drivers are installed, and the cam is operational. Then download and install Vitamin D Video (www.vitamindinc.com). The app is free for single camera installations and is available for both Mac OS X and Windows.

Once you launch the app, a Camera Setup configuration wizard will open (if the wizard doesn't open, the configuration can be completed by accessing the Tools menu and selecting Add Camera). From the Camera Type drop-down choose your camera type (either Network IP camera, or USB / Built-In), and then from the Camera drop-down select the specific camera you'd like to use; then click Next. Vitamin D will test the camera connection. If all is well, click the Next button; if not, ensure that your webcam is working. On the subsequent screen, give the camera location a name (e.g., Office, Front Door, etc.), click Next again, and then click Finish to complete the initial phase of the setup process.

At this point, Vitamin D is capable of capturing video, but a few more tweaks will exploit some of the app's more powerful features. First, go to the Tools menu, select Options, and in the Options menu click the Move Video button to specify a directory other than the default option in which to save your videos. Then switch from the Preview pane to the Search pane by clicking the spyglass at the upper-left of the interface, and click the + button to define some rules. The app can track moving objects or specific shapes and distinguish between cars and people, for example, or even capture objects as they pass through specified thresholds. Once you've got your rules set up, switch on your camera in the app, and it'll capture video as long as the camera is connected.



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- PAX EAST – 3/22
  BOSTON, MASSACHUSETTS
- U. MASS - AMHERST – 3/29
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SUPERCHARGE YOUR ANDROID SMARTPHONE

Over the last few years, as smartphones have gotten more powerful and prolific, wireless carriers have begun polluting them with more and more bloatware, not to mention abhorrent software like Carrier IQ. Perhaps it's the unwanted software or the common enthusiast trait of craving total control over our devices, but rooting or jailbreaking smartphones and flashing custom firmware, aka ROMs, has become increasingly more popular. Not only can flashing a smartphone with a custom ROM eliminate objectionable bloatware, it can also add new features (like Wi-Fi tethering), and potentially increase performance.

The process of flashing a custom ROM to a smartphone is far from universal. In fact, there can sometimes be multiple methods for flashing a single phone. But there are some common threads among the myriad devices. Usually, you'll have to obtain root access, somehow set the phone to accept downloads, use some sort of utility to flash a custom recovery image, and then from within the recovery image, flash the new ROM.

To demonstrate the process, we used a fairly new Samsung Galaxy S II i727 Skyrocket and an alpha build of the excellent CyanogenMod firmware (www.cyanogenmod.com). For specifics regarding your particular phone, we suggest perusing the forums at the smartphone-enthusiast website xda-developers (www.xda-developers.com), which has the goods on virtually all of the popular smartphones available.

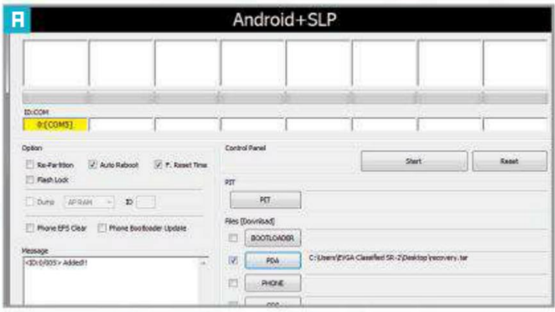
at&t
10:10 AM
Google
Calendar
Messaging
Camera
Market

1 GATHER FILES AND SET PHONE TO DOWNLOAD MODE

To flash the SGSII Skyrocket, we first must grab all of the necessary files, which consist of Odin v1.85, USB drivers for the SGSII, the custom CWM recovery image, and the alpha build of CyanogenMod—all of which are linked in the Skyrocket subforum on the xda-developers site. With all of the files in hand, we next have to put our phone in download mode. To do so, we have to shut the phone off (remove and then reinsert the battery to be sure) and then hold down both the Volume Up and Volume Down buttons, while simultaneously plugging in its USB cable (the other end of which is plugged into a Windows 7 system). Once in download mode, we release the buttons and then hit the Volume Up button one more time to bypass an onscreen warning message and continue on. Next, we install the USB drivers for the phone and once the phone is properly detected by Windows, we fire up Odin. If your phone is in download mode and its drivers are correctly installed, Odin should identify a device on a virtual com port. Here, our Samsung Galaxy S II i727 Skyrocket is identified as device 0 on COM5 **(image A)**.

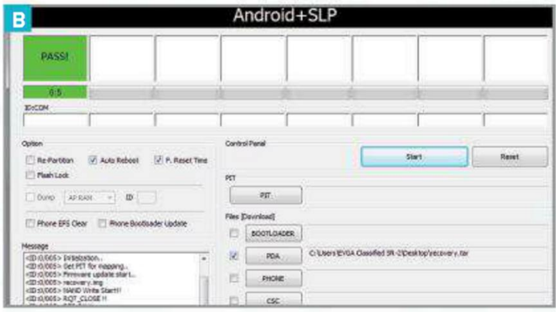
2 FLASH THE RECOVERY IMAGE

With the proper drivers installed and the phone plugged in, Odin immediately recognizes the device and is ready to flash the new recovery image. Odin is capable of flashing bootloaders, recovery images, modems, and some carrier-specific files. For our purposes, we only need to flash the recovery image. To flash the recovery image, we tick the field in Odin labeled PDA and then browse to the CWM recovery image file we had downloaded. With the file selected, we click Start and Odin does the rest. A few moments later the recovery image with CWM is flashed to the phone **(image B)**.


A
Android+SLP
ID:COM
0:[COM5]
Option
Re-Partition
Auto Reboot
F. Reset Time
Flash Lock
Dump
AP RAM
ID
Phone EFS Clear
Phone Bootloader Update
Message
Control Panel
Start
Reset
PIT
PIT
Files [Download]
BOOTLOADER
PDA
PHONE

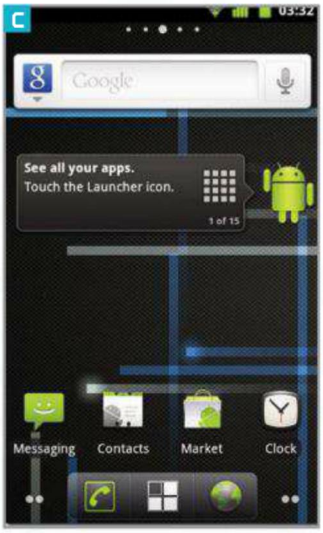
```
<ID:0/005> Added!!
```

☑ PDA C:\Users\EVGA Classified SR-2\Desktop\recovery.tar


B
Android+SLP
PASS!
0:5
ID:COM
Option
Re-Partition
Auto Reboot
F. Reset Time
Flash Lock
Dump
AP RAM
ID
Phone EFS Clear
Phone Bootloader Update
Message
Control Panel
Start
Reset
PIT
PIT
Files [Download]
BOOTLOADER
PDA
PHONE
CSC

```
<ID:0/005> Initialzation..
<ID:0/005> Get PIT for mapping..
<ID:0/005> Firmware update start..
<ID:0/005> recovery.img
<ID:0/005> NAND Write Start!!
<ID:0/005> RQT_CLOSE !!
```

☑ PDA C:\Users\EVGA Classified SR-2\Desktop\recovery.tar


C
03:32
Google
See all your apps.
Touch the Launcher icon.
1 of 15
Messaging
Contacts
Market
Clock

3 FLASH THE CYANOGENMOD IMAGE

With the CWM recovery image installed, we're ready to flash CyanogenMod. First, we power the phone off again and remove the phone's MicroSD card. We then copy the CyanogenMod image to the MicroSD card, reinsert it into the phone, and enter CWM by holding both the Volume Up and Volume Down buttons and simultaneously pressing and holding the power button until the Samsung logo flashes twice on screen. Once in CWM, we clear all of the phone's caches and user data, and follow the onscreen menus to select and flash the CyanogenMod image. Upon restarting the phone, we are done **(image C)**.

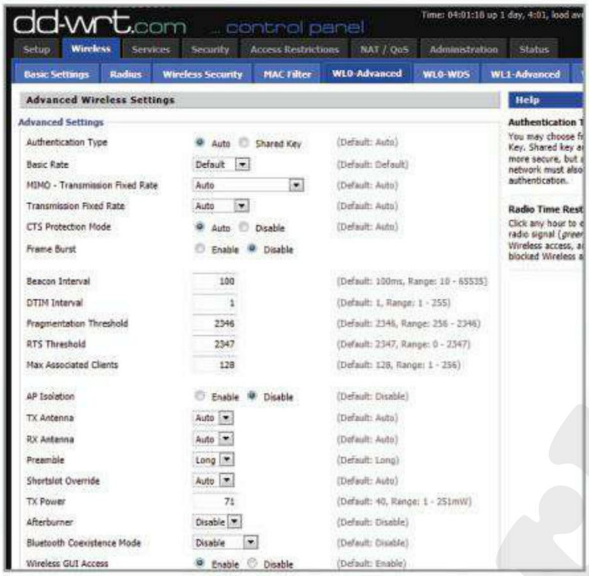
OPTIMIZE WI-FI PERFORMANCE, RANGE, AND COVERAGE

We have explained how to install and use open-source firmware such as DD-WRT (www.dd-wrt.com) and Tomato (www.polarcloud.com) on wireless broadband routers on multiple occasions, so we won't go in-depth on the topic again here. Suffice it to say that using open-source firmware can enhance the performance and stability of a wireless network, enable a number of useful features, and give users a level of control that's unheard of with the stock, bare-bones firmware included with many routers.

Simply installing open-source firmware isn't enough to fully optimize your wireless connection, however. It's a key component to a fast, stable wireless network, yes. But there are changes to the default settings within the firmware and commonsense environmental tweaks you can make that all incrementally enhance overall performance. Within the advanced wireless configuration menus in DD-WRT, for example, there is a setting labeled TX Power, which alters the transmit power of the router. Increase the value in the TX Power field and—you guessed it—the router will transmit a stronger, farther-reaching signal. There are some caveats to altering the TX Power value, though. First off, increasing the value too much can fry the router's radio, so do some research to find the optimal value for your particular router. Although the default value (usually between 40mW and 71mW) may seem low when a maximum value of 251mW is available, cranking things up to the maximum is not advisable. Excessively high TX Power values can not only damage the router's radio, but will also introduce unwanted electrical noise and instability. We'd recommend increasing the TX Power by only a couple percentage points for a small boost in output. If you've got a device that sits on the fringe of your wireless network, a small bump in TX Power may be enough to rope it in with a stronger signal—provided its range isn't limited by its own capabilities.

Another firmware tweak to consider is disabling unneeded wireless modes. If all you've got are N-mode capable devices on the network, there's no need to enable B and G modes, which can drag down peak performance. We also recommend scanning your environment with a utility like inSSIDer (www.metageek.net) to see which wireless channel has the least amount of traffic, and configuring the router to use that channel.

Using a commonsense approach to your router's positioning can also have a huge impact on wireless performance. It's best to keep other wireless devices that may use similar frequency bands, like cordless phones, as far away from the router as possible to minimize the chance of interference. Microwave ovens are also notorious for interfering with Wi-Fi signals. Finally, if possible, position your router in as central a location as possible if you've got to service a large area. Most routers ship with omnidirectional antennas that transmit signals in all directions, so it's best to minimize the distance between the router and any devices that are going to connect to it. The ideal way to do that is to (obviously) make the router the central point between all of your wireless devices.



Advanced Wireless Settings

Advanced Settings

Authentication Type	● Auto ○ Shared Key	(Default: Auto)
Basic Rate	Default	(Default: Default)
MIMO - Transmission Fixed Rate	Auto	(Default: Auto)
Transmission Fixed Rate	Auto	(Default: Auto)
CTS Protection Mode	● Auto ○ Disable	(Default: Auto)
Frame Burst	○ Enable ● Disable	
Beacon Interval	100	(Default: 100ms, Range: 10 - 65535)
DTIM Interval	1	(Default: 1, Range: 1 - 255)
Fragmentation Threshold	2346	(Default: 2346, Range: 256 - 2346)
RTS Threshold	2347	(Default: 2347, Range: 0 - 2347)
Max Associated Clients	128	(Default: 128, Range: 1 - 256)
AP Isolation	○ Enable ● Disable	(Default: Disable)
TX Antenna	Auto	(Default: Auto)
RX Antenna	Auto	(Default: Auto)
Preamble	Long	(Default: Long)
Shortslot Override	Auto	(Default: Auto)
TX Power	71	(Default: 40, Range: 1 - 251mW)
Afterburner	Disable	(Default: Disable)
Bluetooth Coexistence Mode	Disable	(Default: Disable)
Wireless GUI Access	● Enable ○ Disable	(Default: Enable)

Authentication T
You may choose fr
Key. Shared key a
more secure, but
network must also
authentication.

Radio Time Rest
Click any hour to
radio signal (*green*
Wireless access, a
blocked Wireless a

Open-source firmware like DD-WRT gives users the ability to boost the transmit power on many popular wireless routers, which can help increase their range.

REPLACEMENT WI-FI ANTENNAS: THE REAL UPGRADE

Firmware tweaks and repositioning a wireless access point or router can only do so much to improve wireless performance and reception. To take wireless performance to the next level requires upgrading the router's antennas.

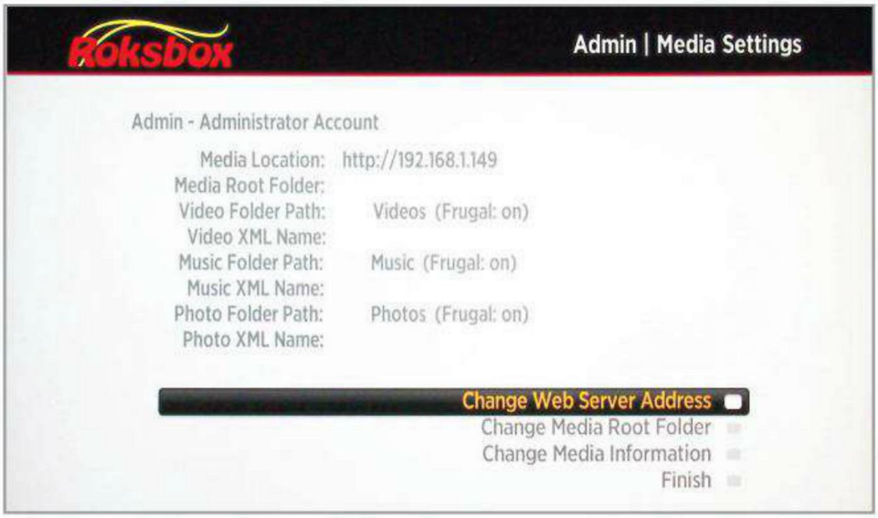
Wi-Fi antennas come in all shapes and sizes, from corner and window mounts, to elongated pole mounts, indoor and outdoor models, and simple replacement rubber-duckies. All of the antennas, however, will typically fall within one of two categories: directional or omnidirectional. The vast majority of antennas included with virtually all commercially available routers and access points (if it has external antennas) are omnidirectional, which is to say they transmit and receive wireless signals from all directions. Conversely, directional antennas better receive and focus transmitted signals in a single direction. Wi-Fi antennas will also carry some sort of dBi rating, which is a measure of the antenna's gain. Higher-gain antennas typically offer longer range and better performance over a given distance in comparison to lower-gain antennas.

Which antenna is best suited to a particular application will be determined by the environment and positioning of the router or AP. A centrally located router in a relatively open area that's servicing systems all around it, for example, would be best served by a high-gain omnidirectional antenna. A router sitting in the corner of a building, which has to transmit a signal to the opposite corner, would benefit from the focused signal of a directional antenna pointed in the proper direction.

Whichever antenna option is best for your setup, one thing is certain: Replacing the basic antennas that come included with most routers with high-gain alternatives will result in an immediate and noticeable improvement in signal quality and range, which ultimately improves performance, as well.

High-gain directional antennas are a surefire way to improve wireless performance, signal quality, and coverage.

STREAM PERSONAL MEDIA TO A ROKU


Roksbox
Admin | Media Settings

Admin - Administrator Account

Media Location: http://192.168.1.149
Media Root Folder:
Video Folder Path: Videos (Frugal: on)
Video XML Name:
Music Folder Path: Music (Frugal: on)
Music XML Name:
Photo Folder Path: Photos (Frugal: on)
Photo XML Name:

Change Web Server Address
Change Media Root Folder
Change Media Information
Finish

Roksbox gives users the ability to stream their own personal content to the Roku player, provided the files are stored on a network-accessible PC and are of the correct format.

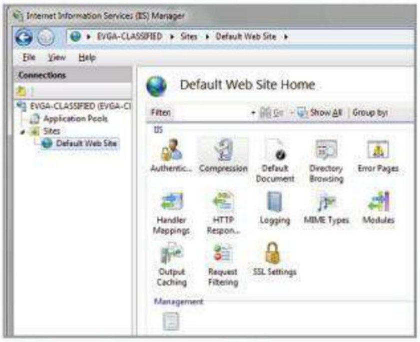
The various Roku set-top devices are some slick pieces of hardware. The diminutive boxes are affordable and allow users to stream a plethora of digital content. As cool as many of the channels on the Roku are, though, not being able to easily stream content from a home network out of the box is somewhat disappointing. Many of us have amassed huge collections of digital media, after all; being able to stream that media from our PCs to a TV with a sub-$100 box the size of a Klondike bar would be handy, indeed.

There is a way to stream personal files to a Roku, however. It's a bit of a pain to configure and costs a few bucks, but in the end it's worth it. By installing the Roksbox channel to your Roku (30 days free, $15 lifetime), strategically arranging your files with a specific directory structure, and setting up what's essentially a web server, Roksbox will allow you to "tune in" to your own personal channel.

Before we explain how to use Roksbox with your Roku, we're going to assume you've already got your device up and running and have an account registered on the Roku site. If so, head on over to the Roksbox site (www.roksbox.com) and click the link at the lower-left labeled "Add Roksbox Channel to Your Roku Player." You'll be taken to a new page and presented with a personalized URL that, when clicked, will take you to the Roku site and add the channel to your selections. Please note: It can take a few minutes (sometimes longer) for the channel to appear in your Roku's interface after being added, so be patient. Once the Roksbox channel is listed in your selections, go to the channel store on the Roku player and select Roksbox.

With the Roksbox channel installed, the next step is to organize your media with a folder structure Roksbox can handle. By default, the channel looks for videos, music, and image files in your Videos, Music, and Photos directories. Create a folder with any name you like (we chose D:\media\) on the machine that'll be serving the files. Inside it, create the Videos, Music, and Photos directories, and copy your media into the folders. Keep in mind, the Roku will only stream MP4 (H.264), MOV (H.264), and WMV/ASF (WMV9/VC-1) video files, AAC and MP3 audio, and JPG and PNG images. MKV files are supported only through the local USB port on the Roku.

The next step is to set up the web server. Windows 7 systems have IIS 7.5 built in; it just has to be enabled. If you prefer to use a different web server, Mongoose or Apache, for example, those will work, too. Our media was on a Windows machine, so we stuck with IIS. To enable IIS on Windows 7, click your Start button and type Windows Features into the search field. The Windows Features menu will open. In it, tick Internet Information Services and then tunnel down in the menu and also tick Basic Authentication. Then click OK and IIS will be installed. Note, if you have a firewall enabled, exclude IIS so traffic can pass through on port 80.


Internet Information Services (IIS) Manager
EVGA-CLASSIFIED ▸ Sites ▸ Default Web Site ▸
File View Help
Connections
EVGA-CLASSIFIED (EVGA-CI
Application Pools
Sites
Default Web Site
Default Web Site Home
Filter:
Show All
Group by:
IIS
Authentic...
Compression
Default Document
Directory Browsing
Error Pages
Handler Mappings
HTTP Respon...
Logging
MIME Types
Modules
Output Caching
Request Filtering
SSL Settings
Management

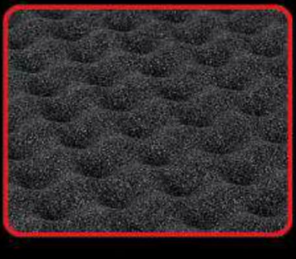
All of the web server's options can be configured through the IIS Manger utility, which is available under Administrative Tools after enabling the feature in Windows.

Next, head into Administrative Tools (go to Control Panel, then System and Security) and launch Internet Information Services (IIS) Manager. When the IIS menu opens, select Default Web Site from the Connections menu, and then click Advanced Settings in the Actions menu. In the window that opens, alter the Physical Path option so that it points to the directory where your media was copied and click OK. Then double-click Directory Browsing in the IIS window and enable it. Next, double-click MIME Types and add the MP4 extension, with the type "video/mpeg."

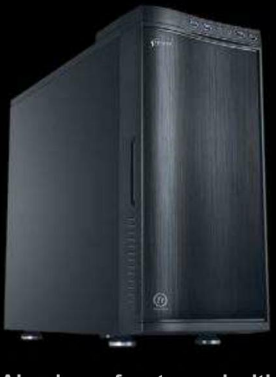
The last three steps are to enable Basic Authentication, disable Anonymous Authentication, and to create a user name with password (if you don't already have one) for login. Select Default Web Site from the Connections menu again and double-click Authentication; you can enable Basic Authentication and disable Anonymous Authentication from there. Once done, close IIS manager and create a new user account if necessary.

With the web server configured, head into the Roksbox settings on your Roku and point it to the IP address of your server. It'll ask for login credentials, and if all is well, you'll then be able to browse the files in the Videos, Music, and Photos directories and stream away. Should you run into any issues, there is an extensive step-by-step How To guide available on the Roksbox site.

Soprano
Just Mute it



Sound-damping foams
for extreme silence



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THE PC BUILDER'S BIBLE

Time-tested tips for PC building that will help you avoid common pitfalls and enjoy a more fulfilling DIY experience

BY GORDON MAH UNG, NATHAN EDWARDS, DAVID MURPHY

PC builders don't drop out of their mommies with a Phillips head screwdriver in one hand, a Leatherman in the other, and start winning PC-building contests. No, most experienced PC builders accumulate their knowledge through horrible mistakes, case scars and flesh wounds, and the sorrow of having to completely take apart a machine they just assembled because a single, crucial step was neglected at some point in the process.

But it doesn't have to be that way. Budding and even experienced PC builders can benefit from the wisdom of others. Thus, in an effort to spare you years of apprenticeship and trial-by-fire—not to mention an unplanned appearance on *The World's Funniest PC-Building Mistakes*—we've assembled the very best PC building tips we've acquired over our years of building, including some choice pointers from the professionals.

WD Black
Desktop Hard Drive
Twin Frozr
msi
VIPER
HDMI

PREP YOUR CASE PROPERLY

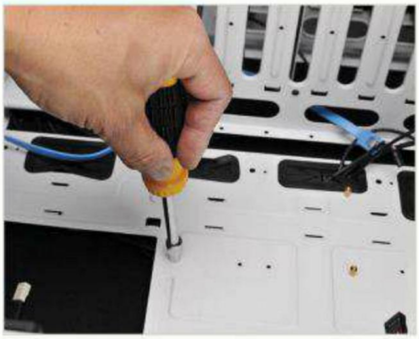
Fight the urge to begin screwing down components faster than you can tear open an antistatic bag. Instead, take a step back, breathe three times, and plan out your build.

TIP 1: HAVE A CABLE PLAN

You've finished installing all of your case's hardware and, like a number of PC builders, you've saved your cable routing for last. D'oh! It will always go a lot smoother if you plan out how you're going to stuff the various cords around your case *before* you fill your system with hardware—*especially* if you're going the full distance and deploying a ton of fans, a huge CPU cooler, water-cooling tubes, etc. For example, trying to run the ATX12V/EPS12V cord from your power supply to the top of your motherboard might very well require you to remove your aftermarket CPU cooler if it's blocking access to the connector. Save yourself a lot of time and heartache by connecting that cable… first!

TIP 2: PLAN YOUR PART ORDER

If you're rocking a case the size of the monolith from *2001: A Space Odyssey*, skip this tip. Folks with smaller chassis, however, will want to keep build order in mind as they go about creating their masterpiece. We recommend going outside in: Get the fans, hard drives, and optical drives situated before you drop in your motherboard, video card, and power supply. As in the step before, the power-supply cables will prove to be an interesting challenge—make sure you're saving space in your cramped chassis for your rat's nest of cables if your case doesn't present you with an easy way to stuff them between the back of the motherboard tray and the side panel.

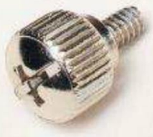


TIP 3: OUR STAND ON STANDOFFS

Ask anyone how tightly you should turn the standoffs for your motherboard and you'll get a thousand different replies. Some recommend going fingers-only tight—but that might very well cause the standoff to turn out with the screw the next time you pull out your mobo. You could grab a 5mm or 3/16-inch socket to give your twisting a bit more *oomph,* but you don't want to tighten the standoff so much that it strips the metal of the hole on the case itself. Our expert recommendation? Finger-tighten if you're the cautious type. If you're daring, use a tool to give the standoffs a spin until they stop moving, then go one-quarter of a turn past that. No more!

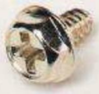
SCREW RECOGNITION GUIDE

There are four common screws used to build every PC. If you're salty enough, you should be able to reach into a bucket of them and, by feel, pull out the right one.



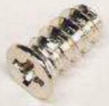
THUMBSCREW

The thumbscrew usually uses the same thread pitch per inch as the #6-32 screw and is provided on nicer cases to fasten the GPU and side panels. In a pinch, these screws can be used on the hard drive and motherboard if there's enough clearance.



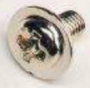
#6-32

The coarse-thread #6-32 in hex-head is the most important screw in your PC and is used to mount everything from a hard drive, to the side panel, GPU, and PSU. In most cases (but not all) it's also used on the mobo. It can also be seen with a flat head or round head.



FAN SCREW

This coarse little bastard is used to mount plastic fans to your case. It works by cutting into the plastic of the fan when you screw it down. Yeah, we know, not exactly a precision instrument but it works well enough—until you strip out the hole in the fan.



M3 HEX

The fine-thread M3 hex or round-head screw has two jobs: the optical drive and the SSD. People commonly mistake the M3 for the coarse #6-32 and use them to screw down the motherboard, but the ill-fitting screws will eventually back out.

TIP 4: SHORT YOUR PSU

There are times when you might need to fire up your power supply to test something on your chassis—lighting or fans, for example—but you don't want to boot (or haven't even connected) the rest of your system. This is an essential step when you're priming the pump for a liquid-cooling setup. Grab a paperclip, unfold it, and cover its central portion with electrical tape, for safety's sake. (Yes, we know this is a risk-free procedure, but still.) If your standard ATX12V PSU is color-coded, jam one end of the paperclip into the big ATX Main Power Connector for the green wire and the other end into any black-wire connection. Plug in some kind of device to your PSU—such as a fan, to put a load on it—and then plug your PSU into the wall. Voilà—on it goes, and you can commence testing.

STEP 5: I/O SHIELD INSERTION

I wish we had we a nickel for every time we forgot to install the I/O shield after assembling more than 90 percent of our system. Here's the deal: Grab it out of your motherboard box and, before you install the motherboard itself, push the I/O shield firmly into place on the rear of your chassis. Remember, you install this sucker from the inside, facing out—the recessed area outlining the I/O shield should snap right into the appropriate area on the inside-rear of your chassis. If you're still a little confused, remember: The bent notches around some of the cutouts on the I/O shield should be folded facing into your case, not the other way around.

TIP 6: CONSIDER FRONT-PANEL COMPATIBILITY

Does your front panel match your motherboard? This can be an issue when you're upgrading parts piecemeal. Suppose, for example, that you're rocking USB 3.0 pass-through cables on your case (they look like standard USB cables), but your upgraded motherboard supports an internal header for USB 3.0. Or, worse, what if your case only supports USB 2.0? You're going to want to take inventory of just what your motherboard and case can handle as far as connections go. If they don't match up, make some adjustments—assuming you use these connections—before you go through the laborious process of building your rig. Incidentally, we have plenty of fixes for this issue, if a new mobo (or case) is just out of the question—check our Doo-Dads sidebar on page 30!

STEP 7: COUNT YOUR MOUNTS

It goes without saying, but make sure you take a look at your case and install your motherboard's standoffs in the correct spots for your ATX/microATX/Mini-ITX/etc. motherboard. Ignore the other holes, lest you accidentally put a standoff where it shouldn't be and short-circuit your motherboard. You'll want to install as many screws as you have standoffs; if you're missing a few screws, then at least try to attach your motherboard to your tray in an even fashion—perhaps making an "X" pattern instead of going for the full, nine-standoff grid, for example. When in doubt, make sure you're "distributing the weight," as it were!

DIY VS. BUY

When we solicited system builders for their expert building tips, a few of the PC vendors told us to go make like bacteria and self-replicate. After all, they argued, it's far better to buy a system from people who do it for a living. Is it really, though? Here are a few key arguments the pros have in their favor.

YOU DON'T HAVE INTEL'S PHONE NUMBER

OEMs, even small ones, have Intel, AMD, Nvidia, and pretty much all of the hardware makers on speed-dial when a problem crops up. And believe us, they get the attention a DIYer couldn't imagine in their wildest water-cooled dreams.

YOU PAY RETAIL

Sure, you might get a killer deal on Slickdeals.net for a particular component, but you mostly pay full retail for parts. OEMs buy parts by the truckload, and if they're big enough, by the freight-train-load. That gives them price margins you'll never touch.

THEY HAVE ENGINEERS

Unlike most DIYers, OEMs, especially the big boys, have engineers that can tell them, well, no you can't run that much hardware with that small a PSU, or, no, that heatsink isn't up to the job. All you have is a bunch of washed-up hacks at a magazine.

THEY GET THE TRUTH

When dealing with the press and public, most corporations would rather ignore a problem than admit they screwed up. With system OEMs, however, parts makers are usually far more frank in warning them not to use one component with another, and then swear them to an NDA.

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TOOLS OF THE TRADE

To build a modern PC, the only tool you *really* need is a $3.99 screwdriver from the local ACE hardware store, but that doesn't mean a few additional tools can't make your PC building life a whole lot easier.

SOCKET
The vast majority of cases use brass standoff studs to mount a mobo. The ghetto method (which we admit to employing at times) is to use a pair of pliers on them. A simple 5mm or 3/16 socket is actually the right tool for the job.

MAGNET
Magnetizing your screwdrivers can make them much more effective in tight or hard-to-reach spots. This is where a dead hard drive comes in handy. Take it apart and extract the heavy-duty magnet that resides under the actuator. Let your tools rest on this bad boy a few seconds to become magnetized.

LIGHT SOURCE
A flashlight or headlamp can make your build go a lot easier. Half our staff prefers handheld "torches," the other favors the head-mounted variety. This Fenix PD32 Ultimate Edition ($70, www.fenixlight.com) puts out a nice warm, floodlight-like beam at up to 740 lumens.

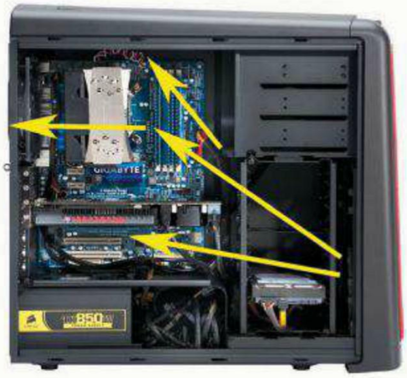
QUALITY SCREWDRIVER
While you can get by with the $3.99 jobbie from the local ACE to build a PC, having a good-quality ratcheting screwdriver, such as this vintage Snap-On SSDMR4 ($64, www.snapon.com), puts less strain on your hand and wrist, and can make your build a true joy.

ARCTICLEAN
Although rubbing alcohol will work for cleaning up a CPU, we prefer ArctiClean, which requires less elbow grease. If you build more than one system, invest in some.

LEATHERMAN
What can we say, it's the Swiss Army Knife of PC building. If a tool's not on there, you don't need it.

HAVE A FAN PLAN

It doesn't matter how clean your wiring is or how powerful your components are if you can't keep them cool. A good fan setup can turn a hot, dusty, and noisy PC into a cool, quiet, clean one. Here are the top tips to look for, whether you're building a brand-new PC or renovating an older one.



TIP 1: FAN PLACEMENT BASICS

The traditional setup is to have a 12cm intake fan in the front of the case, right in front of the hard drives, and a 12cm exhaust fan at the top-rear of the case next to the motherboard I/O ports. This allows simple, unidirectional travel so that air goes first over the hard drives, then over the heat-producing GPU and CPU and motherboard, and then out the rear of the case near the top, because warm air rises. As components have become more powerful, they've started putting out more heat, and case manufacturers have had to add fans to keep up. The most common additions are a side-panel fan for added GPU cooling, and additional exhaust fans at the top of the case. Make sure you have intake fans in the front and exhaust fans in the rear. Side-panel fans should be intake, not exhaust, and top-panel fans should generally be exhaust.

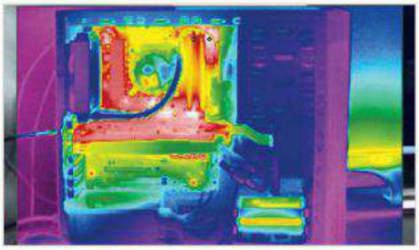
POSITIVE AIRFLOW AND FILTRATION

It's best to have slightly more air intake than exhaust. This creates positive air pressure, which reduces "dead spots" in the case, without air circulation, and it prevents dust from coming in through unfiltered openings. Make sure your intake fans have dust filters, preferably removable. Clean them every month, especially if you have pets or carpets. If your case doesn't come with dust filters, don't buy it. If it's too late, you can get dust filters for a couple of bucks on Newegg. Dust is a great insulator *and* a great killer of components.

Put filtered intake fans on the front panel first, then the side panel if you need more intake (and your case can accommodate side-panel fans). Stick with the standard rear exhaust fan, and add a top exhaust if necessary. There's no need to filter the exhaust fans; no sense trapping in dust.

KNOW WHAT NEEDS TO BE COOLED

If you're air-cooling, the airflow from your case fans and CPU cooler should be sufficient to cool motherboard components such as the voltage regulation modules and your south bridge, but if you're water-cooling your CPU and GPU, those mobo components can overheat from lack of airflow. If you're water-cooling and plan to overclock, consider adding auxiliary cooling to your VRMs and chipset, too. A simple fan is generally enough to keep them cool. If you have a radiator mounted to the top of your case, consider mounting its fans as intake rather than exhaust so you can get more air flowing over the north half of the motherboard. As you can see from the thermal image of a water-cooled rig, the VRMs and the chipset (in red) get the hottest.



Courtesy of Falcon Northwest

TIP 2: THREE PINS OR FOUR?

Most case fans use 3-pin connectors, but some use 4-pin. Most CPU cooler fans use 4-pin. You can control 3-pin fans by changing the voltage to the fans—via the BIOS or a hardware fan controller. You can control 4-pin fans by way of PWM (pulse width modulation) and speeds can be changed in software, and sometimes in the BIOS. Some BIOSes let you switch the CPU FAN headers between voltage and PWM control. Either is fine, although PWM fans can often be tuned to lower speeds than voltage-regulated fans, which usually need at least 50 percent power to spin up, so PWM fans can run more quietly.

TIP 3: MOBO CONTROL OR FAN CONTROLLER

If your motherboard has enough fan headers to control all your case fans, there's nothing wrong with using your mobo to do the job. Some motherboards, like Asus's new ones, include utilities that "auto-tune" your fans based on their speed capabilities and where they are in the case.

If you have a *lot* of fans or want really fine-grain control, you can get a stand-alone fan controller. Many cases come with built-in fan controllers, though most are rudimentary. Some top-end ones have fan-speed readouts and some have temperature sensors, so you can tweak until it's just right.

PSU GUIDELINES

Don't overdo it, but play it safe

With today's efficient CPUs and GPUs, you may not need the behemoth PSU you've been eying. We used three online PSU calculators from reputable sources to configure a box built on a Core i7-3930K, a GeForce GTX 680, four DIMMs, an SSD, HDD, ODD, and four fans. The recommendations ranged from 400 to 650 watts. That may sound low to you, but we have one editor who runs a GeForce GTX 690, overclocked Ivy Bridge CPU, and six HDDs on a name-brand 650-watt unit with no issues "so far."

Our general guidance, though, is still to err on the side of caution by building in a little more headroom than you need. If a PSU calculator recommends a 600W for you, think about a 750W. This overprovisioning will help you in the hot summer months when your PSU will be pushed to its limits. Remember, an overloaded PSU will have a shorter life.

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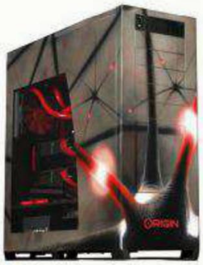
THE PROS CHIME IN

We do it for fun, but the OEMs—the professionals—do it for a living. We asked a few key players for some tips to aid the common nerd.

KELT REEVES, FALCON NORTHWEST

"Your case is the critical first build decision, and where DIYers often buy mainly on price or looks. Start by considering size and form factor. With 4TB drives, and even Mini-ITX motherboards loaded with features, few people really need tons of expansion anymore. Next, investigate the airflow patterns and noise, primarily determined by its cooling fans. Fans are where chassis makers tend to skimp, as four high-quality fans cost more than a cheap case. Your case is what you'll look at, interact with, and probably keep longer than most components. So devote some thought and budget to a quality enclosure."



JORGE PERCIVAL, ORIGIN PC

"When building a custom liquid-cooling loop, it is important to first test all components for any leaks, visualize the entire loop, and check where components are going to be located, so you gain a better idea of how the liquid will flow through the blocks. Always have the reservoir above the pump—this will guarantee your pump never runs dry. If possible, always dump heat by having the liquid go through a radiator before going back to another high-heat component. Try to avoid having the GPU liquid going right into the CPU without dumping heat. This is a common mistake people can make. Before filling for the first time, check all fittings and plugs to make sure they are covered."

HARJIT CHANA, DIGITAL STORM

"Cable management is important not just for airflow and aesthetic reasons, but it makes future upgrades easier. When routing your cables, instead of bundling all of them together, separate your power supply, SATA, and chassis audio/USB cables into their own smaller bundles."

ADRIAN HUNTER, GEEKBOX

"Take your time. Chances are, you don't build several machines per day. As such, the level of satisfaction and joy you will receive by allotting yourself enough time to build your system will ensure that both the system and your experience are rewarding. Instead of rushing through your build, consider giving yourself three days to perfect every aspect of your build. From inspection of your new parts and careful integration to beautiful wiring—giving yourself enough time to critique your work before turning the machine on will pay in spades. Also pre-test your hardware before implementing a complex liquid-cooling solution. More often than not, this will save you countless hours of dealing with a possible headache. In the process, you can also find a baseline of how your system performs before your massive cooling upgrade. Once you have concluded you have a solid foundation to build upon, construct your cooling loop outside of your build and leak-test for 24 hours. By spending the time to follow these steps, you will avoid landmines that are all too prevalent within the enthusiast community."

JOSH COVINGTON, VELOCITY MICRO

"Heat is your enemy. When building an enthusiast-level machine, your goal should be finding ways to improve airflow and pull heat away from vital components to increase the longevity and overall reliability of the system. But this doesn't mean you have to do something crazy like invert the components, invest in an insane liquid-cooling solution, or install obnoxiously loud fans. We've found the simplest and most effective way to keep a system cool is to wire as neatly and cleanly as possible—this keeps the air moving through and out like it was designed to."

MISHA TROSHIN, AVA DIRECT

"Consider going above what you need for your power supply by at least 20 percent. Avoid cases without sufficient space behind the motherboard tray for cable routing. Using cases with hard drive cages facing the side panel will help improve internal aesthetics. Do not underestimate Electrostatic Discharge (ESD) significance. Use a grounding kit when handling memory or other sensitive components, especially in dry air conditions. Be aware that many of today's motherboards do not support Smart Fan functionality with non-PWM fans, so be sure to get PWM fans to avoid excessive noise. When overclocking your system, give preference to Offset Mode. If computer-building isn't your hobby, to save time and money go to a professional builder with fair pricing and lifecycle support."

MOTHERBOARD/CPU MATTERS

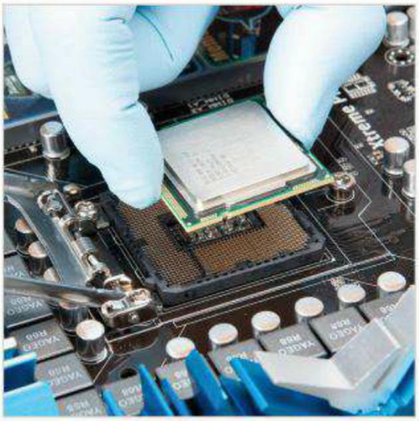
Setting up the motherboard and CPU is often the most daunting task to a new PC builder. If you step back and think about it, though, installing the mobo and CPU are a lot less intensive than wiring up the PC in a neat manner. It's really not that bad. Still, there are a few basic guidelines every builder should heed.

TIP 1: DON'T OVERTIGHTEN IT

A rookie mistake to avoid when building your system is screwing in the board so tight with the first screw that you can't nudge it about. Instead, after you've put in the first screw, leave it sloppy enough so you can shift the board. If your case isn't the best quality and has very loose tolerances, you may even want to put a card in the slot to make sure the board is in properly. Some newer cases even include a center mounting point that doesn't need to be screwed down. Instead, you plop in your board and use the center point to orient your board to the exact position it needs to be.

TIP 2: KEEP IT PARALLEL

Intel actually makes a special field insertion and removal tool for its CPUs, but unless you're building systems all day, your fingers can do the walking. The proper way to insert a land grid array CPU is to hold it parallel to the socket and gently lower it straight in. Don't drop one side in and then the other, or try to slide it around the socket—you may kill your motherboard.



TIP 3: MIND THE NOTCHES

CPUs usually have small triangles to denote where to insert the CPU, but we've found the mark is difficult to see under poor lighting. In addition to the golden triangle that either lines up with a triangle or notched corner on the socket, you can also use the notches cut into the side of the CPU to help guide your proc into its home.

TIP 4: GETTING THE RAM RIGHT

Before you place RAM in your board, always read the manual for the proper placement of DIMMs. Different memory controllers in different Intel and AMD CPUs means you have a very high probability of hobbling your memory bandwidth or possibly preventing your box from even booting at all if the RAM is in the incorrect slots. One of the most common mistakes builders make is not inserting the RAM with enough force into the slots. Most people do this because they don't want to damage the motherboard, but boards are actually pretty tough. Once you've made sure the RAM is properly lined up with the key, or notch, in the RAM slot, push the module into place until the arms lock on both sides. You should barely be able to see the contacts if properly installed.

TIP 5: GREASE IT GOOD

Like fan holes, everyone has an opinion on the proper application of thermal paste. How much, how little, and where it goes are issues of hot contention. Two methods have worked well for us: Put a dab the size of a grain of rice or BB smack-dab in the center of the heat spreader and then sandwich the cooler on it. This will spread the paste out in the center of the CPU where the cores are. The other method that also works well is to put the same amount of thermal paste on the CPU, and stick your finger into a clean plastic bag and evenly spread it over the CPU heat spreader. The real key to applying thermal paste is not to use so much that it acts as an insulator. If it's oozing out the sides, you went too far. Just because the heatsink came with a tube, doesn't mean you should use it all.

TIP 6: KNOW IEEE 1394 FROM USB 2.0

We were never huge fans of how IEEE 1394 (aka FireWire) was implemented. Among the many reasons we're not sorry to see FireWire go is the tendency to mix up FireWire headers and USB headers. Both have similar pin-outs, so it's easy to accidentally plug your PC's front USB 2.0 ports into a FireWire header. Since FireWire carries a crapload of power, and on the wrong pins for USB, you could easily damage your devices in a heartbeat.

Char
SPDIF_O
F_1394
SYS_FAN4
TPM

TIP 7: BE A COVER SNOB

True connoisseurs of build techniques will show their colors when talking about the plastic cover on the LGA2011 socket. Some say the right method is to leave the cover in place and let the CPU pop it out when you close the lid. Others say to just pop it out with your finger first. Both cite Intel as their source. Who's right? Both, actually. We've seen official Intel videos showing both methods in use. Both ways work and neither is wrong. More importantly, you may be tempted to toss the cheap plastic cover from your motherboard socket, but don't. Most motherboard companies require that the plastic piece be in place and protecting the socket should you ever return the board for repair or replacement.

GPU WISDOM

Installing a modern GPU doesn't take much effort beyond ensuring adequate airflow going to it. Still, for more advanced users, there are a few things to consider when you run multiple GPUs, as well as thinking—oddly enough—about your storage options before you install your GPU. Intrigued? Read on.

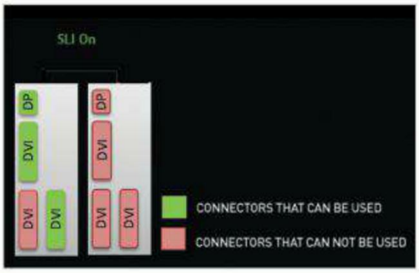
TIP 1: A BRIDGE TOO FAR

For those of you building multi-GPU systems, it's always confusing how to set up the bridge properly. On the Nvidia side, a given motherboard should come with multicard bridges for all of the SLI configurations the board supports, so don't expect a four-way SLI bridge on your microATX board. On the AMD side, the bridges come packaged with the GPU.

Installing the bridge on a two-card SLI build is always confusing. Do you put the bridge on the front or rear connectors? The answer: It doesn't really matter. In fact, we tested a pair of GeForce GTX 680 cards using the latest drivers and found no difference between the two scenarios. Still, for some reason, we prefer to put the bridge on the connectors closer to the rear of the PC. AMD's CrossFireX is the same, with the bridge location making no discernible performance difference.

TIP 2: QUAD-SLI PORT PROTOCOL

Few of us will be running two GeForce GTX 690 cards, but there's a secret to doing it correctly. Most of us assume that all of the connectors work fine in quad SLI. That's not true, and using ports other than those designated for quad-SLI use will result in unstable behavior that most experienced builders will attribute to a bad PSU, bad RAM, or other hardware issue. When you are running quad SLI, the first DVI port will give you issues. Instead, plug your monitor into the second or third DVI port on the top GPU, or into the DisplayPort on the first video card, to avoid random lockups related to an improper configuration.



TIP 4: USE SEPARATE CABLES

If your GPU requires a pair of 6-pin or a 6-pin plus 8-pin connector, consider using separate cables from the PSU rather than a combination cable that places the load on the same cable. If you have a borderline-undersize PSU or low-quality PSU, it may not be capable of supplying all the power the GPU needs, so if the option is available to use two different cables to power up your GPU, do so.

TIP 5: MIND THE SLOTS

All of the slots in a motherboard might look the same, but the wiring under those slots often varies. For optimal performance, use the top slot for your GPU, as it should be the x16 physical and x16 electrical slot. We'll be honest, a x8 PCIe slot on third-gen technology provides the same bandwidth as a x16 PCIe slot on second-gen—but there should be absolutely no reason in any modern motherboard or case or odd heatsink that should prevent you from using the top slot.

TIP 6: INSTALL SATA FIRST

If you're wondering why we put a storage tip within the GPU section, it's because the two go hand-in-hand. That's because most newbs make the mistake of installing their double-wide GPU before they wire up their drives, only to find they can't access their internal SATA ports without pulling the GPU. That's why we recommend that you install your SATA cables first. In fact, we recommend installing more SATA cables than you need.

PC-BUILDING DOO-DADS

The vast majority of issues you'll run into with your PC are usually related to mismatched or short wiring. To help you solve those problems, we've collected a handful of the most useful and often ignored pieces of hardware that every PC DIYer should know about.

EXTENSION CABLES

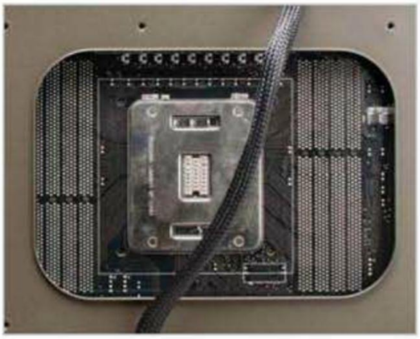
Phobya's sleeved extension cables let you route your case's power switch, reset, and LEDs the way you want to—not strung tight as a piano wire.
$9, www.phobya.com

USB 2.0–TO–USB 3.0 ADAPTER

If your case has USB 3.0 front ports, but your older motherboard doesn't, this Silverstone adapter lets you press those front ports into action, albeit at slower USB 2.0 speeds.
$10, www.silverstonetek.com

COOLER AND STORAGE TIPS

With instructions typically smaller than a Bazooka Joe comic strip, the process of mounting a cooler is often the most challenging task. Here are a few tips to keep you out of trouble.



TIP 1: INSIDE OR OUT?

Most new cases have big cutouts in the mobo tray to allow you to install a CPU cooler and its backplane after you've installed your motherboard, but those are more useful for someone swapping out a cooler in an existing build. You should install at least the cooler's backplate and mounting system onto the motherboard before putting the motherboard into your case. It'll probably be easier to install the cooler and RAM as well, to make sure they play well together. The only reason to install the cooler after the motherboard is in the case is if it's a tricky fit, or there's stuff (like the ATX12V/EPS12V 8-pin connector or a motherboard mount) you won't be able to reach once the cooler is installed.

TIP 2: RAM CLEARANCE

Certain big CPU coolers like the Noctua NH-D14 or Phanteks PH-TC14PE overhang one or more RAM slots, so RAM with big heatsinks may not fit. RAM heat spreaders are almost entirely for looks, while the cooler is mostly for performance, so when in doubt, go with the CPU cooler.

TIP 3: USE THE RIGHT PARTS

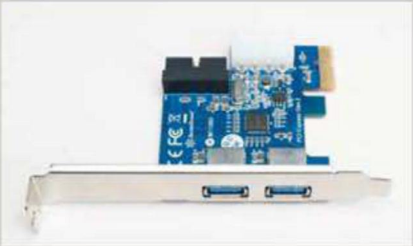
Aftermarket cooler makers are notorious for not clearly labeling the brackets, screws, and bits that ship with their coolers. Sometimes it's a faint ink stamp on the bag that you can hardly read. So before you rip open the bags like a kid on Christmas, make sure you only open the bag you need. They're usually separated by socket type. You don't want to use the bracket for AM3+ with the screws for LGA1155 and the mount for LGA2011.

TIP 4: LABEL YOUR CABLES

When you install your cables, we recommend that you install more cables than you need. If you are only running three drives in your box, go ahead and plug in the SATA cables for four or five and run the cables to where those drives will go. This saves you the trouble of having to pull your GPU should you need to add a second SSD or HDD down the road. While you're at it, consider labeling the cables so you know which cables go to SATA 6Gb/s and which go to SATA 3Gb/s on your Intel board. AMD users, use your Nelson Muntz laugh on the Intel users.

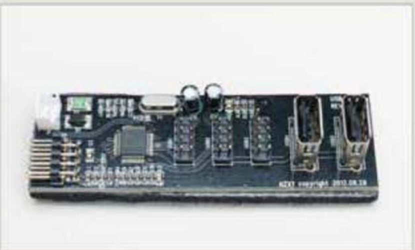
TIP 5: TORQUE TALK

Read the instructions then read them again. Most of the time you'll tighten the mounting screws until they stop turning. Don't overtighten from that point or you could damage your mounting screws, backplate, cooler, or even motherboard.



USB 3.0 CARD

If you'd rather have your front USB 3.0 ports run at full speed, this Silverstone PCIe USB 3.0 card gives your mobo SuperSpeed capability and even two more ports out the rear.
$29, www.silverstonetek.com



USB EXPANSION

Those "smart" liquid coolers, PSUs, and other components can easily eat up all of your internal USB headers. NZXT's IU01 Internal USB Expansion hub lets you turn one USB 2.0 header into three and gives you two more internal USB plugs, too.
$19, www.nzxt.com

MORE EXTENSION CABLES

Running out of cable length can stop your build dead or make for nasty wiring. A set of USB 2.0, FireWire, and HD Audio cables from Apevia can get your build working in a jiffy.
$5, www.apevia.com

Cont. →

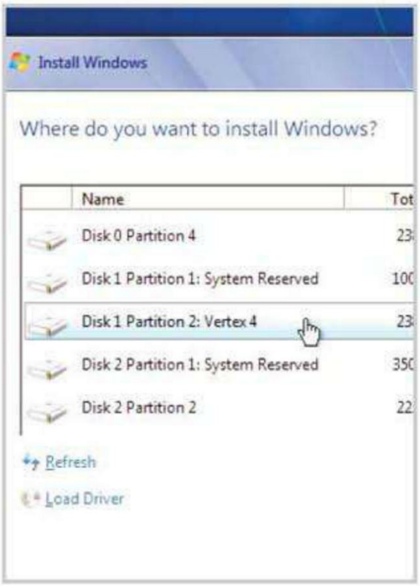
worldmags

TIPS FOR A SUCCESSFUL INSTALL

If you've successfully built a PC and it boots in one step, you're in great shape. But that's only half the battle. Now, you must install your OS to get it up and running. Here are a few handy tips to get your system going without issues.

TIP 1: DISCONNECT EXTRA DRIVES

If you're installing the OS on a machine with multiple drives, disconnect any secondary or tertiary drives from the system before installing the OS. Additional drives can, on occasion, "confuse" the Windows installer, and more importantly, if you have a second drive with data files on it, you're unlikely to accidentally wipe it out by installing the OS to the wrong drive.

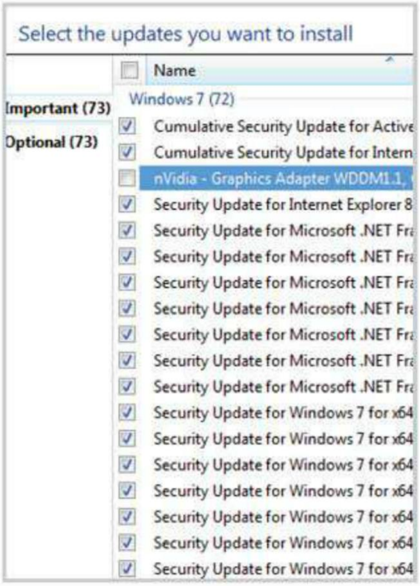


Where do you want to install Windows?

Name	Tot
Disk 0 Partition 4	23
Disk 1 Partition 1: System Reserved	10(
Disk 1 Partition 2: Vertex 4	23
Disk 2 Partition 1: System Reserved	35(
Disk 2 Partition 2	22

TIP 2: FOREGO THE WINDOWS UPDATE DRIVERS

Don't forget to install the latest drivers for your video card before you run Windows Update. If you update Windows first, it'll try to find drivers on its own, and they could either be Windows native drivers (which will suck for gaming) or an out-of-date version of the correct drivers.


Select the updates you want to install

☐ Name

Windows 7 (72)

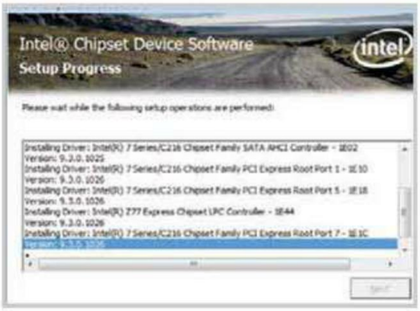
- ☑ Cumulative Security Update for Active
- ☑ Cumulative Security Update for Intern
- ☐ nVidia - Graphics Adapter WDDM1.1,
- ☑ Security Update for Internet Explorer 8
- ☑ Security Update for Microsoft .NET Fr
- ☑ Security Update for Microsoft .NET Fr
- ☑ Security Update for Microsoft .NET Fr
- ☑ Security Update for Microsoft .NET Fr
- ☑ Security Update for Microsoft .NET Fr
- ☑ Security Update for Microsoft .NET Fr
- ☑ Security Update for Microsoft .NET Fr
- ☑ Security Update for Microsoft .NET Fr
- ☑ Security Update for Windows 7 for x64
- ☑ Security Update for Windows 7 for x64
- ☑ Security Update for Windows 7 for x64
- ☑ Security Update for Windows 7 for x64
- ☑ Security Update for Windows 7 for x64
- ☑ Security Update for Windows 7 for x64
- ☑ Security Update for Windows 7 for x64

TIP 3: DOWNLOAD THE LATEST DRIVERS

The motherboard DVD or CDs are usually pressed very early-on in the development of the product, so the drivers and software are likely to be immature. To get the freshest install, download the latest LAN drivers for your board and install them to get Internet access for your machine. Now, download the latest drivers from your motherboard maker's website.

TIP 4: THE PROPER DRIVER ORDER

When installing drivers (besides the LAN driver to download the other latest drivers), our motto is an easy one to remember and follow: "Chipset drivers, then the rest."



Please wait while the following setup operations are performed:

```
Installing Driver: Intel(R) 7 Series/C216 Chipset Family SATA AHCI Controller - 1E02
Version: 9.3.0.1025
Installing Driver: Intel(R) 7 Series/C216 Chipset Family PCI Express Root Port 1 - 1E10
Version: 9.3.0.1026
Installing Driver: Intel(R) 7 Series/C216 Chipset Family PCI Express Root Port 5 - 1E18
Version: 9.3.0.1026
Installing Driver: Intel(R) Z77 Express Chipset LPC Controller - 1E44
Version: 9.3.0.1026
Installing Driver: Intel(R) 7 Series/C216 Chipset Family PCI Express Root Port 7 - 1E1C
Version: 9.3.0.1026
```

SATA-TO-MOLEX ADAPTER

One thing we hate is having to run an entire cable just to access a single 4-pin Molex adapter for internal accessories. The Frozen CPU SATA adapter lets you instead power Molex adapters from a SATA power connector.
$6, www.frozencpu.com

POWER EXTENSION CABLE

The ATX12V/EPS12V cable is one of the longest cable runs in the system and sometimes your PSU can't hack it. In those cases, an ATX12V/EPS12V cable gets the job done.
$10, www.silverstone.com

EXTERNAL-TO-INTERNAL USB 3.0

USB 3.0 pass-through cables are unsightly and rob your mobo of two rear USB 3.0 ports. Silverstone's External-to-Internal USB 3.0 Cable Adapter solves that by letting you route the pass-through ports to the internal motherboard header.
$12, www.silverstonetek.com

TROUBLESHOOTING TIPS

There's nothing worse than flipping the power switch on a new PC and having absolutely nothing happen. Rather than running to the Internet to return all of the hardware you just bought, there's a certain order of business you should follow when she won't boot.

CHECK YOUR POWER

On any DOA new build, start by first checking if the power switch for the front-panel connector is wired up correctly. If your motherboard has a built-in power switch, try that.

Now start looking at your power connectors. Check the Main Power Connector, the major power umbilical that plugs into your motherboard, to make sure it's firmly in place, as well as the ATX12V/EPS12V connector near the CPU socket. Also check the auxiliary power to the GPU. And of course, check the cables to the PSU as well as the PSU's power switch. Of course, you're sure your monitor is powered up and the video cable is in, right? If you're not sure if your PSU is even firing up, consider starting the unit using our short-circuit trick on page 25, with a single case fan hooked up to it.

RESEAT

Once power is eliminated as a culprit, it's time to start checking the components. Turn off the PSU or just unplug it and begin reseating components. Start with the RAM, and then move to the GPU and other add-in cards. Pay particular attention to the RAM. First, make sure you have them installed in the right slots. Certain Intel CPUs won't fire up at all if the RAM is in the wrong slot. On the off chance you have bad RAM, try running just one DIMM at a time. Remember that when the PSU is hot, power is going to the RAM, CPU, and PCIe cards and there is always a remote chance of damaging the components if you muck with them with the power on, so switch it off.

RESET THE CMOS

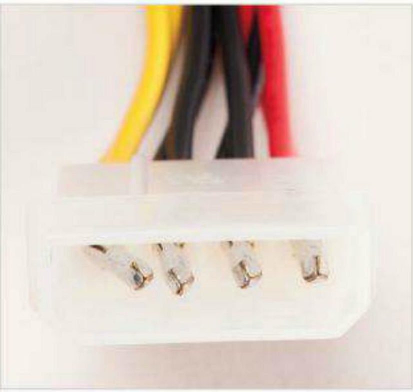
Cut the power to the system and then find the jumper on your motherboard, or use the external CMOS reset button on your system to reset the board's settings. If you can't find the CMOS reset, simply remove the coin-cell backup for 10 seconds and then replace it. If you're lucky, some unusual board state was causing the boot problem.

CHECK THE POST CODE

If your machine starts to POST but hangs, look up the board's LED POST error in the manual to see if you can gauge where in the process the PC is hanging. If your machine doesn't have a POST code, try listening to the system's beep codes. This is a series of Morse Code–like short and long beeps that can tell where the hang-up is. If your board isn't making any beeps, it's possible you don't have an internal speaker hooked up, as many mobo makers leave these off for cost reasons. We actually keep handy a speaker that can be plugged into any motherboard. They're available online for about $5 and every builder should have one.

PULL EXTRA PARTS

You've just finished the easy part of your troubleshooting. Now it's time to look at more serious matters. Pull all extraneous hardware from the system that you don't need, such as soundcard, and PCIe adapters other than the GPU, and unplug all of the drives from the motherboard and PSU as well as any extraneous items such as fan-bay adapters and lights. Four-pin Molex adapters are prone to shorting out if the pins aren't properly lined up when you plug them in. This can cause the system to fail to POST, as the PSU senses a short and shuts down. Again, you can try booting the box after you unplug each device if you want to isolate it. We usually unplug everything and if it boots, start plugging in each device until we can repro the problem.



RESEAT THE CPU

At this point, you've exhausted all the low-hanging fruit. Now it's time to take more drastic measures. The first step is to pull the processor. A badly seated processor could prevent the system from booting. Once the CPU is out, grab your flashlight to look at the socket for bent pins. A botched CPU install can do this. If the socket is clean, replace the CPU and try booting the box again. If it's still dead, it's now time to pull the entire motherboard out of the system. It's possible you're grounding out the board against the case. You can try reseating the board or possibly booting the system using the CPU's integrated graphics chip. We don't recommend that you try to fire it up externally with a discrete GPU, as the unsupported video card could damage things even further.

IT'S PROBABLY YOUR MOTHERBOARD

You're now nearly out of options, but if you can beg, borrow, or steal a CPU for you board, you can try a CPU swap on the off chance you have a dead chip. Be advised, the chances of getting an out-of-the-box dead processor are extremely rare. More likely, you have a bad motherboard—or perhaps a board that won't work with your CPU without a BIOS update. Still, if the board won't fire with a known good CPU, a piece of RAM, and nothing else hooked up to it, the board is probably to blame.

worldmags

RECOVER AND RESTORE

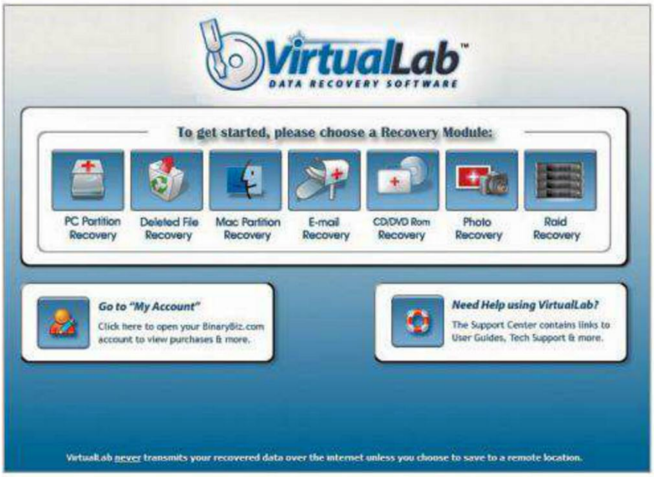
FILE AND DISK RECOVERY SOFTWARE CAN SAVE THE DAY WHEN YOUR DATA HAS BEEN DELETED OR CORRUPTED

BY RICHARD COBBETT

Cold sweat beading on the brow. Panic rising from the stomach. The shaking hand that scrolls the mouse in a vain attempt to locate that incredibly important, but absent file. These symptoms will be all too familiar to anyone who has accidentally deleted a file, or found that a hard drive or USB stick they've been relying on has become corrupted. While the Recycle Bin sometimes catches accidentally deleted files, there's no guarantee of that, and Murphy's law dictates that you'll empty the Recycle Bin just before you notice your mistake.

Luckily, there's a range of software available that can trawl your hard drive and reconstruct lost data. While the programs themselves aren't glamorous, they possess fascinating capabilities that prove that very rarely is anything truly deleted or lost, unless you somehow drop the hard drive into a vat of acid. While this fact has obvious security implications if you ever chuck out or give away an old PC or hard drive, the usefulness of recovery software cannot be denied.

Of course, it's incredibly important to make the right choice if you're going to trust a piece of software to recover your files. As you'll see in this roundup, while a lot of the products offer similar features and produce similar results, there are big discrepancies in price. We put eight file recovery programs through their paces to find out which ones you should trust.



To get started, please choose a Recovery Module:

Go to "My Account"
Click here to open your BinaryBiz.com account to view purchases & more.

Need Help using VirtualLab?
The Support Center contains links to User Guides, Tech Support & more.

VirtualLab never transmits your recovered data over the internet unless you choose to save to a remote location.

BINARYBIZ VIRTUALLAB

Great recovery app, poor pricing

VIRTUALLAB IS an impressive performer, with one unfortunate twist: its pricing model. You don't buy it as an individual program. Instead, you pay as you go, and $40 is only worth a pathetic 100MB of recovered files. And if that doesn't seem stingy, the next level up is $99 for 500GB. Putting a fixed limit on how much you can recover is odd, but to jump from effectively nothing to half a terabyte is just plain bizarre.

The tools themselves are excellent, though. While File Undelete is the obvious go-to utility, VirtualLab also handles standard partition recovery, supports Mac partition types, and will even have a go at recovering a RAID system. As far as undeleting goes, its regular scan is blisteringly fast and the tools it uses to search through what it finds are easily the best of all the programs here. You can browse the directory tree at will, search the recovered files for specific types, or look something up by name—and VirtualLab serves up results instantly.

Close investigation reveals that the rest of VirtualLab offers this kind of one-step-further care and attention. When recovering files, for example, you can save to a drive, but this is the only tool in this lineup that also lets you output files to an FTP server instead. On our test system, we had trouble with the application's photo tool—for some reason it turned up no images, despite having found plenty of both in a general File Undelete sweep. A shame, really.

But, ultimately, it's the pricing model that holds this tool back. You can try it out with a desultory 1MB of free recovery and see what it can save, but for practical use, you're looking at $100 for the 500GB version.

VERDICT
8

BinaryBiz VirtualLab

$100 for 500GB, www.binarybiz.com

BRIAN KATO RESTORATION

It says what it does, and does it

RESTORATION IS a quick-and-dirty data-recovery tool. Options? Choices? Forget it. Everything the utility does is presented on a single screen, and it's not very much at all. Pick a disk. Enter a filename if you're looking for something specific. Decide whether or not you want to be bothered by files with a size of zero. Press the "Search deleted files" button to scan your drive. Done.

In testing, Restoration turned up as many files as its competitors and offered a couple of advantages. It's only 400Kb in size, for example, and doesn't require installation. That makes it convenient if you only have one drive and don't want to risk overwriting the data you are trying to recover. It's also much easier to use than the Linux alternatives, and it's free.

The downsides are firmly interface related. There's no indication of how damaged files might be, no way to browse the tree of recovered files by directory, and searching is a slow process.

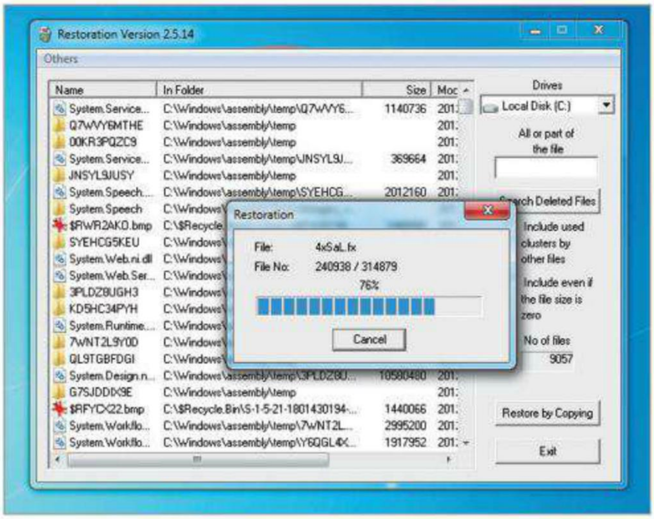
Most frustratingly, though, there's no way to restore multiple files at once. The list won't let you group-select or do a mass restoration of everything that's uncovered. The cut-down approach also means that you can forget about restoring from devices like cameras. Even USB stick support is brushed off in the Read me file as, "a user reported that it worked correctly." Finally, you're not likely to use the included shredder utility, as it zaps all the deleted files it finds, with no targeting whatsoever.

For a basic recovery tool it works well enough, but there's little reason to choose it over the more powerful utilities unless you're looking for a tool to go on a system-restoring USB stick.

VERDICT
5

Brian Kato Restoration

Free, bit.ly/katorestore

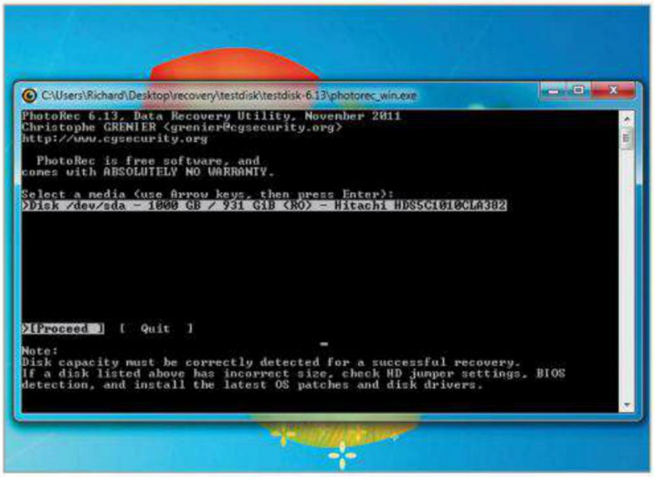

Restoration Version 2.5.14
Others
Drives
All or part of the file
rch Deleted Files
Include used clusters by other files
Include even if the file size is zero
Restore by Copying
Exit
Restoration
Cancel

Name	In Folder	Size	Moc
System.Service...	C:\Windows\assembly\temp\Q7WVY6...	1140736	201:
Q7WVY6MTHE	C:\Windows\assembly\temp		201:
00KR3PQZC9	C:\Windows\assembly\temp		201:
System.Service...	C:\Windows\assembly\temp\JNSYL9J...	369664	201:
JNSYL9JUSY	C:\Windows\assembly\temp		201:
System.Speech...	C:\Windows\assembly\temp\SYEHCG...	2012160	201:
System.Speech	C:\Windows\		
$RWR2AKO.bmp	C:\$Recycle		
SYEHCG5KEU	C:\Windows\		
System.Web.ni.dll	C:\Windows\		
System.Web.Ser...	C:\Windows\		
3PLDZ8UGH3	C:\Windows\		
KD5HC34PYH	C:\Windows\		
System.Runtime....	C:\Windows\		
7WNT2L9Y0D	C:\Windows\		
QL9TGBFDGI	C:\Windows\		
System.Design.n...	C:\Windows\assembly\temp\3PLDZ8U...	10580480	201:
G7SJDDIX9E	C:\Windows\assembly\temp		201:
$RFYCX22.bmp	C:\$Recycle.Bin\S-1-5-21-1801430194-...	1440066	201:
System.Workflo...	C:\Windows\assembly\temp\7WNT2L...	2995200	201:
System.Workflo...	C:\Windows\assembly\temp\Y6QGL4X...	1917952	201:

Drives: Local Disk (C:)

File: 4xSaL.fx
File No: 240938 / 314879
76%

No of files: 9057


C:\Users\Richard\Desktop\recovery\testdisk\testdisk-6.13\photorec_win.exe

```
PhotoRec 6.13, Data Recovery Utility, November 2011
Christophe GRENIER <grenier@cgsecurity.org>
http://www.cgsecurity.org

  PhotoRec is free software, and
comes with ABSOLUTELY NO WARRANTY.

Select a media (use Arrow keys, then press Enter):
>Disk /dev/sda - 1000 GB / 931 GiB (RO) - Hitachi HDS5C1010CLA382





>[Proceed ]  [  Quit  ]

Note:
Disk capacity must be correctly detected for a successful recovery.
If a disk listed above has incorrect size, check HD jumper settings, BIOS
detection, and install the latest OS patches and disk drivers.
```

CGSECURITY TESTDISK AND PHOTOREC

A double-whammy of data recovery

WE'RE PUTTING these two open-source tools together because united they can take care of both data-recovery extremes. TestDisk is the broadsword. It works on whole partitions and non-booting disks—typically, in the aftermath of a virus attack or major human error. PhotoRec is the scalpel. It digs up individual files, from photos to videos, documents, and archives; it then re-assembles them as well as possible.

Both come from the world of Linux, but PhotoRec, in particular, is easier to use than you might expect, with menus to flag the file types you want and a recovery process that spits everything onto a safe drive for you to sift through. It's as good at pulling information from memory cards as hard drives—an increasingly common feature in these tools.

TestDisk is a much more complicated beast, asking for details such as "disk geometry" and throwing out a stream of jargon. It features analysis tools that will try to work out many of the details if you don't know them, but don't expect to just hit a button and bring back your disks after a crash.

Both tools are small, and neither requires any form of installation. That makes them perfect for use on an emergency USB stick and custom recovery discs, and together they're not even a megabyte. As a rule, they'll be the go-to tools on any Linux-based disc. They're not the ideal tools to learn while sweating at the thought of losing a vital file, but they'll help keep you cool if you've already learned the ropes before disaster strikes.

VERDICT 9

CGSecurity TestDisk and PhotoRec

Free, www.cgsecurity.org

GENIE9 TIMELINE PRO 2012

Help put problems back in the bottle

GENIE TIMELINE Professional 2012 offers a different take on data recovery. It doesn't pick apart the detritus on your hard drive or try to salvage deleted files. Instead, it's a live backup tool. Install it, point it to another location (ideally a spacious second hard drive), and it keeps track of and copies anything that you add, delete, or change on your primary disk.

The main benefit of this is that you're not just protected against data loss, but far more common data accidents. Yes, Windows 7 boasts something similar, but it's not particularly useful on a minute-by-minute basis, especially if you accidentally overwrite something you've been working on all day.

Genie Timeline also provides a disaster recovery disc creator for pulling files from a broken system. It can scan everything on your system, limit its actions to specific folders, or look for file types such as pictures. It can also make a pseudo-backup of your iPod, for instance, though only by copying backups already made by tools like iTunes.

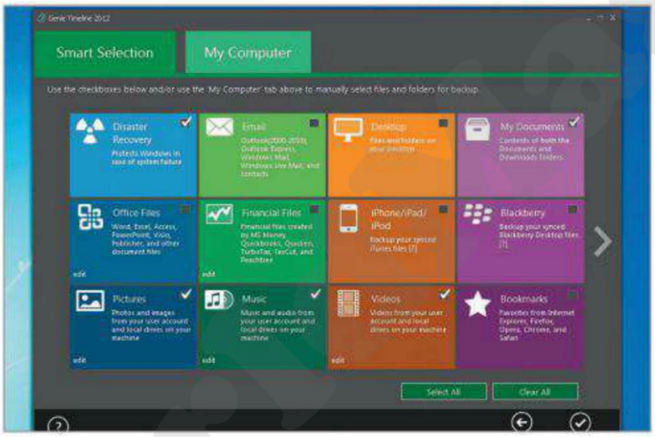
There are some oddities, however. Files aren't restored to their original location, but to a directory of your choice. This makes sense when working with undeletions—the more you mess with a drive, the more you risk damaging files—but here, a simple "put that back" button would be more fitting. Backups also work on a long timer—a minimum of three minutes—whereas tools like Dropbox work live.

Provided you have a second drive, Genie Timeline Pro 2012 is a handy way to keep a copy of your most important files, with the advantage that you get something out of it even if disaster doesn't suddenly strike.

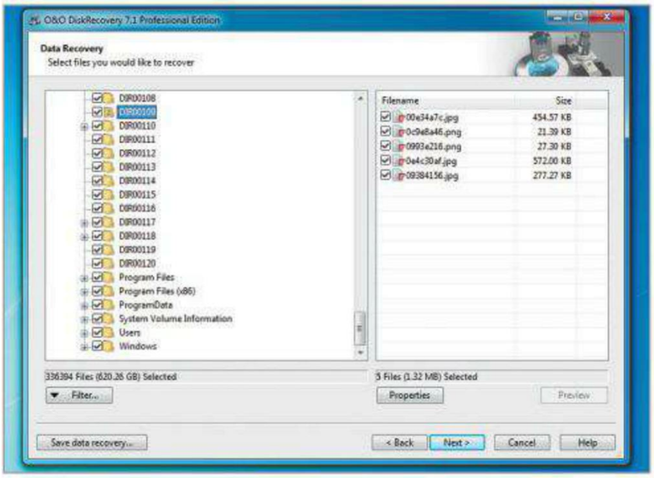
VERDICT 7

Genie9 Timeline Pro 2012

$60, www.genie9.com


Genie Timeline 2012
Smart Selection
My Computer
Disaster Recovery ✓
Protects Windows in case of system failure
Email
Outlook(2000-2010), Outlook Express, Windows Mail, Windows Live Mail, and contacts
Desktop
My Documents ✓
Contents of both the Documents and Downloads folders
Office Files
Word, Excel, Access, PowerPoint, Visio, Publisher, and other document files
Financial Files
Financial files created by MS Money, Quickbooks, Quicken, TurboTax, TaxCut, and Peachtree
iPhone/iPad/iPod
Backup your synced iTunes files
Blackberry
Backup your synced Blackberry Desktop files
Pictures ✓
Photos and images from your user account and local drives on your machine
Music ✓
Music and audio from your user account and local drives on your machine
Videos ✓
Videos from your user account and local drives on your machine
Bookmarks
Favorites from Internet Explorer, Firefox, Opera, Chrome, and Safari
edit
Select All
Clear All

Use the checkboxes below and/or use the 'My Computer' tab above to manually select files and folders for backup.


O&O DiskRecovery 7.1 Professional Edition
Data Recovery
Select files you would like to recover
DIR00108
DIR00109
DIR00110
DIR00111
DIR00112
DIR00113
DIR00114
DIR00115
DIR00116
DIR00117
DIR00118
DIR00119
DIR00120
Program Files
Program Files (x86)
ProgramData
System Volume Information
Users
Windows
Filter...
Properties
Preview
Save data recovery...
< Back
Next >
Cancel
Help

	Filename	Size
☑	00e34a7c.jpg	454.57 KB
☑	0c9e8a46.png	21.39 KB
☑	0993e216.png	27.30 KB
☑	0e4c30af.jpg	572.00 KB
☑	09384156.jpg	277.27 KB

336394 Files (620.26 GB) Selected

5 Files (1.32 MB) Selected

O&O DISKRECOVERY 7

Bring your data back with ease

COSTING MORE than twice as much as many of its paid-for competitors, O&O DiskRecovery 7 is on the defensive even before it's installed. Its primary advantages are its ability to handle formatted and damaged partitions, and its very powerful engine that's used regardless of whether you do a quick or deep scan. It stumbles in some other functions, though, especially post-scanning.

This isn't to say it's complicated to use. In most cases, you just point it to the partition, pausing only to specify individual file types (if you don't want everything) and whether you want to save files automatically or be presented with a list.

Unlike many tools, you're not allowed to restore to the disk you're recovering files from—but that's good sense. The catch comes if you're looking for specific files. You can't scan for them exclusively, or even target directories—only file types, with the option to add a couple of filters, such as size and date of creation. The finished report offers no search box to help drill into it either—an unfortunate omission. The result is that while O&O works superbly if you have a crash or drive-wide disaster to take care of, it's not so effective for day-to-day deletions and recovering from small-scale accidents.

If you do end up needing its heavy lifting, there's not much that escapes O&O's eagle eye. It handles hard drives, flash cards, USB sticks, and more. Its partitioning support is extremely useful, and the option for an "Instant" installation if you're bringing it in to clean up is a handy touch. For the general home user, though, you can get similar results more cheaply elsewhere.

VERDICT 8

O&O DiskRecovery 7

$99, www.oo-software.com

PC TOOLS FILE RECOVER

A little too simple

FILE RECOVER is as simple as data recovery gets. Where others have several screens to wade through, here everything is provided on just one—the option to choose a quick scan, deep scan, or physical scan; to target only specific file types; and not much more.

It also offers a couple of less common options, such as the ability to target a single filename, and to recover files from a directory to the right-click menu. The latter may or may not be very useful, as it only performs a quick scan; deleted files are likely to have been moved to the Recycle Bin in any event, and therefore will not show up in the search. It also offers no support for cameras or other media devices.

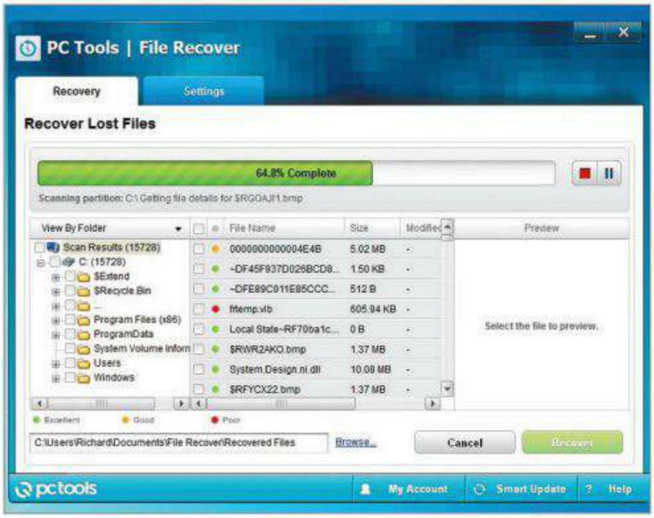
While File Recover has no trouble digging up an impressive number of files—if somewhat more slowly than many others here—its recovery screen is lacking. There's no way to filter the results of a scan after getting the list, nor to scan to see if it found a specific file. Recovered files are color-coded by how damaged they are, but that's all the detail available—no header information, for example, as in Recuva. Most frustrating, though, is that you can't resize the very small window, leaving the important matter of each file's location at the mercy of a scroll bar.

File Recover turned in a solid, but unexceptional performance. It's one of the easier tools to use, and while a bit slower than the others, its recovery performance was up to scratch. You'll probably miss the options on offer elsewhere, though, and it's worth noting that while the price appears much lower than many, it's a year's subscription rather than an outright purchase.

VERDICT 5

PC Tools File Recover

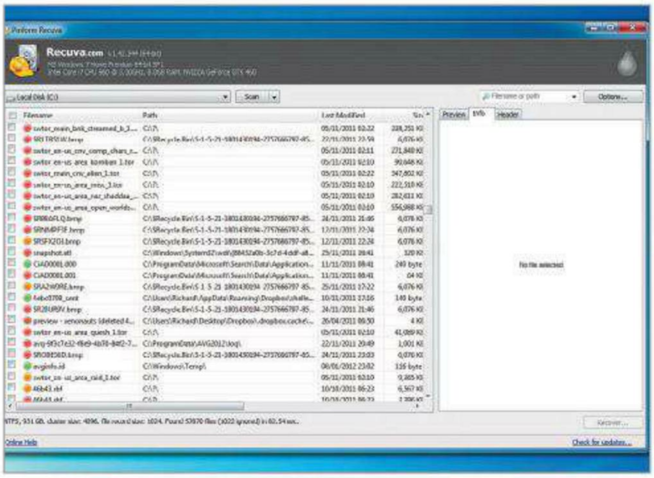
$30 a year, www.pctools.com


PC Tools | File Recover
Recovery
Settings
Recover Lost Files
64.8% Complete
View By Folder
Scan Results (15728)
C: (15728)
$Extend
$Recycle.Bin
Program Files (x86)
ProgramData
System Volume Inform
Users
Windows
Preview
Select the file to preview.
Excellent
Good
Poor
Browse...
Cancel
Recover
pctools
My Account
Smart Update
Help

Scanning partition: C:\ Getting file details for $RGOAJI1.bmp

☐	●	File Name	Size	Modified
☐	●	0000000000004E4B	5.02 MB	-
☐	●	~DF45F937D026BCD8...	1.50 KB	-
☐	●	~DFE89C011E85CCC...	512 B	-
☐	●	fltemp.vlb	605.94 KB	-
☐	●	Local State~RF70ba1c...	0 B	-
☐	●	$RWR2AKO.bmp	1.37 MB	-
☐	●	System.Design.ni.dll	10.08 MB	-
☐	●	$RFYCX22.bmp	1.37 MB	-

C:\Users\Richard\Documents\File Recover\Recovered Files



PIRIFORM RECUVA

A powerful and free solution

RECUVA IS AN amazing tool with only one serious flaw: It can't head back in time and install itself on your PC before disaster strikes. Beyond that, it does everything right. It's fast, it's easy to use, and best of all, it's completely free.

As with all tools, you get a standard scan and a much slower, deep scan. If you know what you want to retrieve, you can point Recuva toward individual file types, as well as destinations from the Recycle Bin to attached devices. Everything is presented in a simple list that can be sorted and searched. Files are flagged according to their quality: green for perfect, yellow for partially overwritten but possibly still of use, and red for unrecoverable. You might still be able to salvage something from the red camp, but don't expect Recuva to perform miracles.

You can select many files and recover them at once, but there's no direct way of putting them back where they came from as if nothing happened, although you can obviously do this by hand. As a bonus, you can also securely overwrite any files to prevent them from being recovered (at least without forensic tools), though filenames can still be found.

The only annoyance is when searching through potentially recoverable files. This is done via a live search box; the sheer number of files it churned through as we typed brought our quad-core i7 test machine to a crawl. On a full search, it's best to copy and paste queries instead of typing them in one letter at a time.

There's no good reason not to use Recuva. Other suites may have more tools, but nothing comes close to its value, reliability, and ability to save your bacon.

VERDICT 9 KICK ASS!

Piriform Recuva

Free, www.piriform.com/recuva

UBUNTU RESCUE REMIX

Data recovery for the sysadmin

UBUNTU RESCUE REMIX is the hardcore solution for bringing your data back to life, with one minor drawback—unless you're comfortable with booting from a live CD and only seeing a blinking cursor, it really isn't for you. There's no pretty GUI and no wizard to talk you through things—just a carefully chosen set of open-source tools with the power to bail you out of trouble.

Those tools are split into three categories: Filesystem, Disk, and Other. These include TestDisk, as seen separately here, along with Photorec for pulling back media specifically, and Magic Rescue for more general files. Working as a live CD means that there's nothing to install, which in turn means that you can pull the plug as soon as you realize you've deleted a file and have a good shot at getting it back.

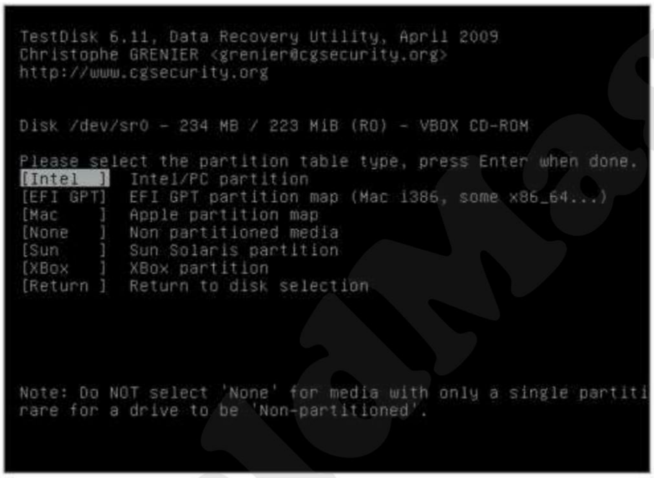
They're powerful tools, but choosing the wrong options and firing up the wrong programs can do more harm than your original accident. Together, though, they can do far more than any individual program here, and make for an excellent emergency rescue disc. Documentation is primarily provided in the form of manual pages on the disc itself, along with a cheat sheet, and tutorials on the web page that cover the basics.

If you'd like to try this pack out, the best way is with VirtualBox (www.virtualbox.org). Create a new disk, mount the ISO, and play around with the knowledge that you can't harm anything on your real PC. If it proves too much, other boot CDs are available, such as www.ultimatebootcd.com. That one includes TestDisk and Photorec, which are the main tools you'll use for regular file recovery.

VERDICT 8

Ubuntu Rescue Remix

Free, ubuntu-rescue-remix.org



```
TestDisk 6.11, Data Recovery Utility, April 2009
Christophe GRENIER <grenier@cgsecurity.org>
http://www.cgsecurity.org


Disk /dev/sr0 - 234 MB / 223 MiB (RO) - VBOX CD-ROM

Please select the partition table type, press Enter when done.
[Intel  ]  Intel/PC partition
[EFI GPT]  EFI GPT partition map (Mac i386, some x86_64...)
[Mac    ]  Apple partition map
[None   ]  Non partitioned media
[Sun    ]  Sun Solaris partition
[XBox   ]  XBox partition
[Return ]  Return to disk selection



Note: Do NOT select 'None' for media with only a single partiti
rare for a drive to be 'Non-partitioned'.
```

WorldMags

FILE RECOVERY SOFTWARE COMPARED

SPECIFICATIONS

	BinaryBiz VirtualLab	Brian Kato's Restoration	CGSecurity TestDisk/ PhotoRec	Genie Timeline 2012	O&O DiskRecovery 7	PC Tools File Recover	Piriform Recuva	Ubuntu Rescue Remix
Website	www.binarybiz.com	bit.ly/katorestore	www.cgsecurity.org	www.genie9.com	www.oo-software.com	www.pctools.com	www.piriform.com/recuva	ubuntu-rescue-remix.org
Price	$100 for 500GB	Free	Free	$60	$99	$30 per year	Free	Free
Number of PCs	1	Unlimited	Unlimited	1	1	3	Unlimited	Unlimited
Dedicated Photo Recovery	Yes	No	Yes	N/A	No	No	Yes	Yes
Requires Installation	Yes	No	No	Yes	Yes	Yes	No	No
Works with Partitions	Yes	No	Yes	N/A	Yes	No	No	Yes
Integrated File Shredder	No	Yes	No	No	No	No	Yes	No
Quick Scan Time on Test PC	00:37:00	04:06:00	N/A**	N/A	00:17:00	06:37:00	01:24:00	N/A**
No. Files Found on Test PC*	58,131	60,453	N/A**	N/A	57,186	58,057	57,870	N/A**

* According to program. This doesn't guarantee successful recovery of detected files. ** No dedicated quick scan available for comparison purposes.

AND THE WINNER IS...

File recovery is an emotive subject. After all, you'll only seriously consider it when you're desperately trying to get an essential file back. And you won't be doing it in a calm fashion, either. You'll need something that can pinpoint the files in question, give you the good (or bad) news as quickly and clearly as possible, and then get those files back for you. Most of the applications we've looked at here do that to some degree or other, but as always, it's the details that matter.

The surprising revelation from this roundup is not so much that some utilities are more capable than others, it's the variation in pricing models employed. From the simply barking pricing of BinaryBiz's VirtualLab to the power of the utilities that'll cost you nothing at all, if you're looking at getting files back, you really can spend as much as you want to.

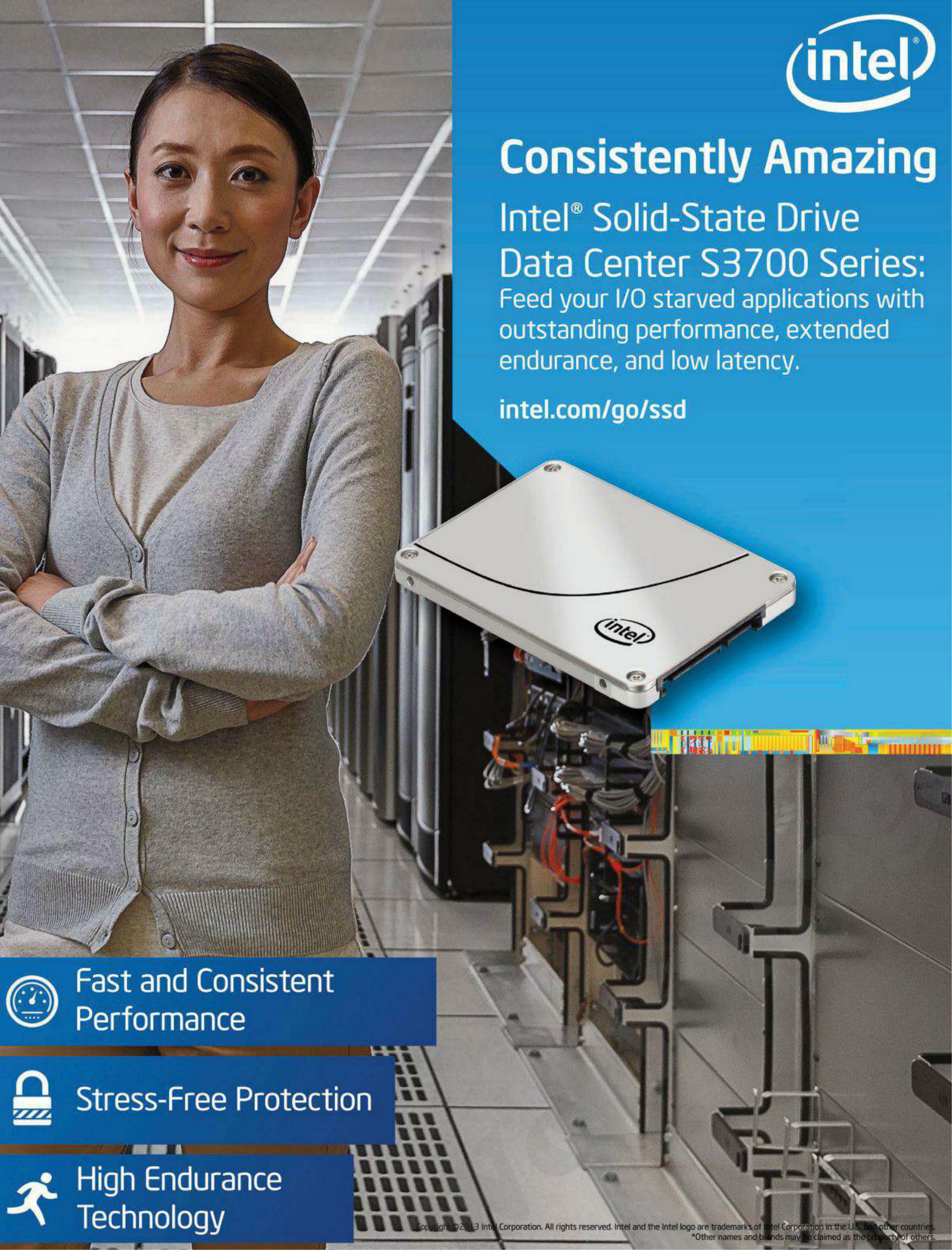
For once, paying more doesn't necessarily mean you get a better service, either. The two standout applications for us cost nothing at all, yet boast incredible raw power.

CGSecurity TestDisk/PhotoRec

When a free program wins our Kick Ass award, it can pose a bit of a quandary when selecting a runner-up. We felt that while TestDisk and PhotoRec offer amazing power and features for free, they don't match the user-friendliness of Recuva. You might notice that Ubuntu Rescue Remix scored well, but was only awarded an 8 verdict overall. This is because we just can't recommend it due to its complexity and the harm it could cause if not used correctly.

Piriform Recuva

It's powerful, full of features, works incredibly well, and is free. Is there anything not to like? While there's usually a catch or caveat following a sentence like that, Recuva manages to avoid such pitfalls. The best thing we can say about it is that it works well, is easy to use, and includes features that even some paid-for applications are missing. If you've lost a file and are looking for a quick and easy way to get it back, make sure you use Recuva.


Consistently Amazing
Intel® Solid-State Drive Data Center S3700 Series:
Feed your I/O starved applications with outstanding performance, extended endurance, and low latency.
intel.com/go/ssd
Fast and Consistent Performance
Stress-Free Protection
High Endurance Technology

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TRACK DOWN!

DON'T LET A LOST OR STOLEN LAPTOP RUIN YOUR LIFE—NOT WHEN THERE'S TRACKING SOFTWARE THAT CAN BAIL YOU OUT

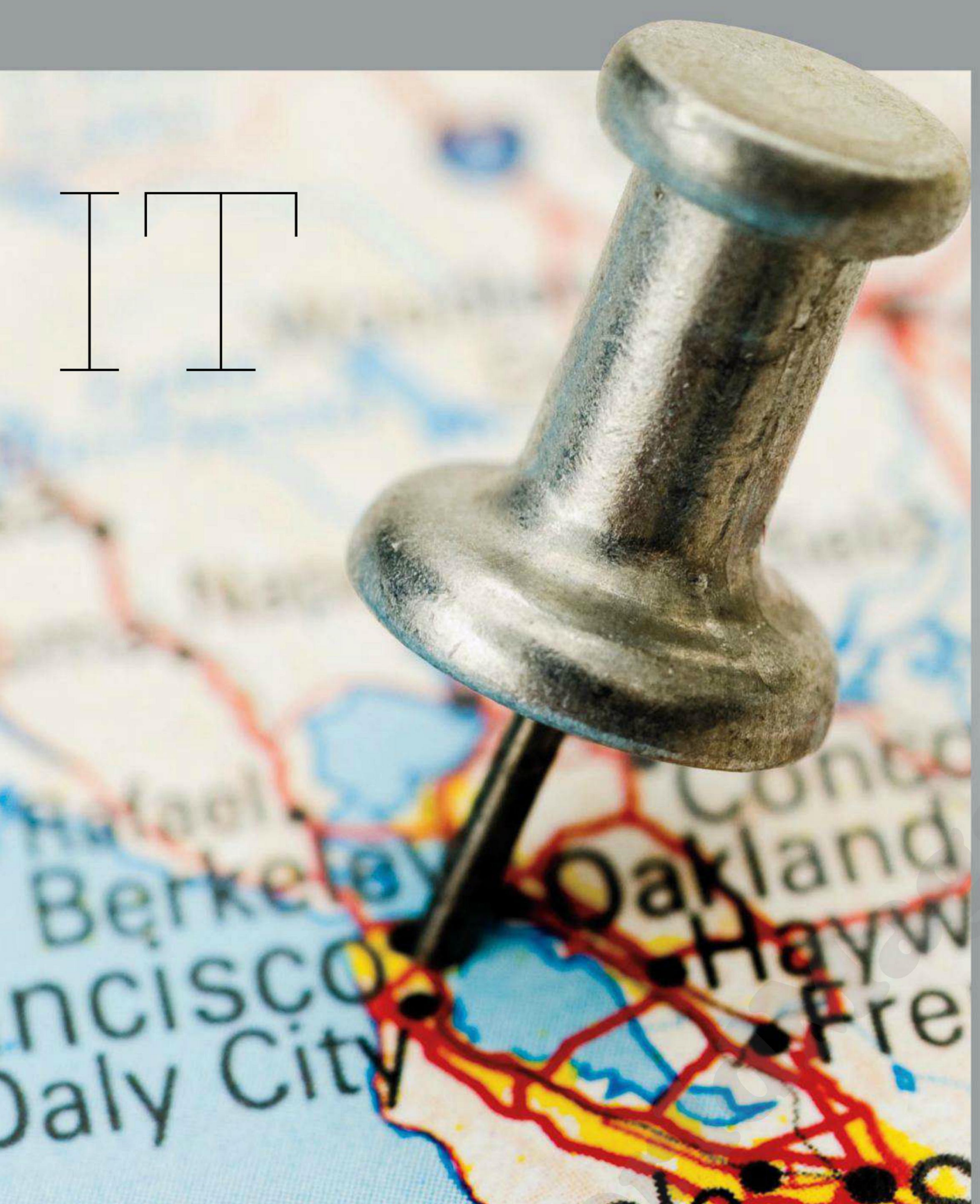
By Matt Hanson

LOSING A LAPTOP, whether by misplacing it or by theft, can be devastating. Not only is the financial loss tough to get over—laptops aren't cheap, after all—but the loss of personal files, documents, photos, and other data can be even more upsetting. It can also be potentially very dangerous, as any criminal who snatches your laptop could then have access to your email or online banking accounts, which combined with other personal data on your laptop could make you a prime target for identity theft.

Thanks to laptop security and tracking software, the fate of a stolen laptop needn't be so dire. This month, we've rounded up eight programs intended to add an extra layer of security to your laptop should disaster strike. At the very least, they should allow you to remotely lock down your laptop and wipe sensitive data. In a best-case scenario, such software will allow you to track and retrieve your laptop and, if it's been stolen, provide evidence to the police for a conviction.

Can the software we've rounded up deliver on these promises? Let's investigate.

IT



EXO5

Biz package spies on, er, tracks many devices

EXO5 IS PRIMARILY geared toward small-to-medium businesses, but that shouldn't put off home users—especially if you have a number of devices you want to keep track of.

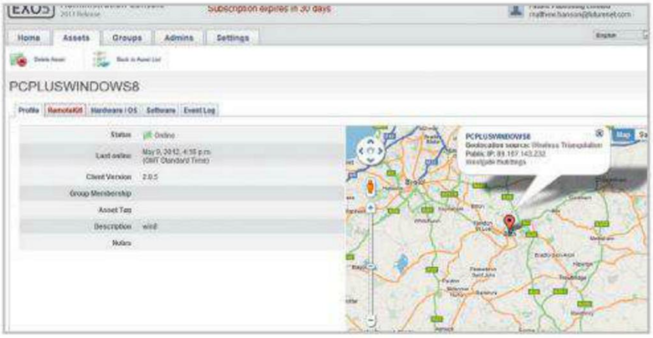
A free 30-day trial lets you sample the goods before purchasing. After signing up for an account, you'll head to the Settings tab of the Administrative Console and download the Agent Installer, a standalone .exe file that needs to be run on any device you want EXO5 to track. Once done, you can view the devices by clicking the Assets tab.

When you select an asset to track you'll be shown its location on Google Maps, using similar Wi-Fi triangulation technology as the other services we've tested here. In EXO5's case, it got the road right but was a few buildings off, while some of its competitors were more accurate. The public IP address is also displayed, along with whether the device is connected to the Internet.

The Hardware/OS section lists your devices' hardware configuration, and isn't much use unless you need to see if someone has swapped any of the parts in your laptop.

The Software tab offers more illuminating details of what programs have been installed on the laptop, while Event Log keeps you up to speed on what your laptop's being used for. Most of these features cater to an individual or company that wants to make sure the laptop is being used for its intended purposes.

Of most value is the incredibly handy RemoteKill option. This enables you to encrypt files and folders remotely if the laptop is stolen. Presets such as "All Microsoft Outlook .pst files" make it quick and easy to secure important info. You can also add a boot-sector lock to shut down the device—and both can easily be reversed if the laptop is recovered.



PCPLUSWINDOWS8

Status Online
Last online May 9, 2012, 4:55 p.m. (GMT Standard Time)
Client Version 2.0.5
Group Membership
Asset Tag
Description win8
Notes

EXO5 uses geolocation to track your devices with a fair degree of accuracy.

FEATURES

RemoteKill file encryption, drive lock, curfew, geolocation, logs, data export, RiskSense alerts

VERDICT 7

EXO5

$495/3 years on 25 devices, www.exo5.com

FRONTDOORSOFTWARE

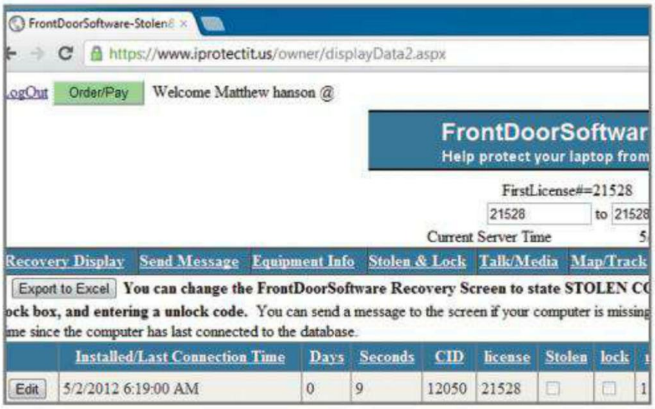
Protection that makes itself known

FRONTDOORSOFTWARE is a laptop protection and tracking tool that, despite being free to download, comes with some of the features found in paid-for software.

While our evaluation is focused more on how well a program protects a laptop, and not on aesthetics, we still must point out the noticeable lack of user-friendliness of FDS's design, which makes relatively simple actions more complicated than they need to be. A case in point: The installation process includes a slightly bewildering SetLicense window with a number of buttons and text boxes and little to no description of what each one does. Spelling mistakes in the online instructions don't inspire confidence either.

Once installed, our laptop had to be rebooted and afterward sported a FrontDoorSoftware window with a warning that the device was protected, alongside the usual Windows login screen. You can also send a custom message to the screen. However, that alerts thieves that they need to act fast to remove the software. Your contact information is also displayed in case the laptop is simply lost, so a good Samaritan can contact you to return it.

FrontDoorSoftware uses Wi-Fi positioning technology courtesy of Skyhook (www.skyhookwireless.com) and the results were respectable, with the approximate location just 60 yards off. However, the software runs as a second-user account, so it has an impact on the system's performance. You can remotely lock the device and mark it as stolen through a web interface, which can only be unlocked with a code.



Welcome Matthew hanson @

FirstLicense#=21528

21528 to 21528

Current Server Time

You can change the FrontDoorSoftware Recovery Screen to state STOLEN C
ock box, and entering a unlock code. You can send a message to the screen if your computer is missing
me since the computer has last connected to the database.

	Installed/Last Connection Time	Days	Seconds	CID	license	Stolen	lock
Edit	5/2/2012 6:19:00 AM	0	9	12050	21528	☐	☐

FDS allows you to send a custom message to be displayed on a stolen or missing laptop.

FEATURES

Geolocation, stolen alert display, remote lockdown, start-up audible prevention alert, custom text message

VERDICT 6

FrontDoorSoftware

Free (or $30/3-year license with unlimited location tracking), www.frontdoorsoftware.com

GADGETTRAK

Tracks with frequent reports and sly webshots

GADGETTRAK protection involves downloading and installing the software onto your laptop and registering it with your GadgetTrak user account. You can then log on to www.trak.me and use the control panel to enable tracking. You'll get email reports every half hour, with various bits of information to help you locate a missing laptop.

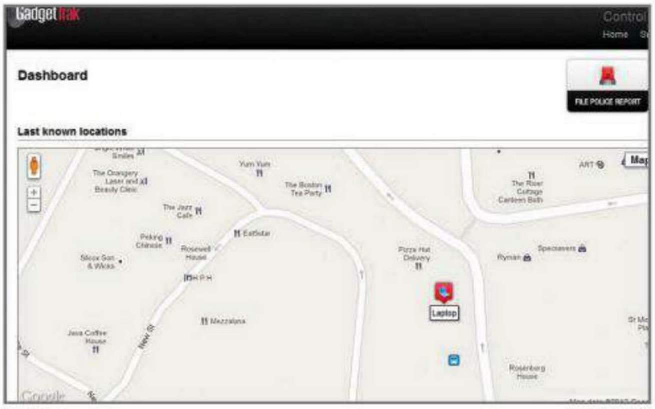
Arguably the most useful part of the report is the Wi-Fi-based location section, which provides you with the latitude and longitude of your device's location based on its Wi-Fi connection and the networks surrounding it. There's also a handy link to Google Maps with an icon indicating the approximate location of your device.

In our tests, the location information was a couple of buildings off of the actual location. While it's not pinpoint-accurate enough to go and retrieve your laptop there and then—not that you should attempt to if it's been stolen—you'll at least have an idea of its general vicinity.

Occasionally, the location would jump around a bit, pointing in roughly the same area but giving the impression the device was being moved about when it actually wasn't. The report also includes a snapshot taken with the laptop's webcam, and will hopefully catch the thief using the laptop at that moment. However, you can't choose when to take snapshots and there's no option to change the frequency of the reports.

FEATURES

Wi-Fi positioning, webcam support, integrated police reports, online dashboard



If you're lucky, GadgetTrak will use your laptop's webcam to snap a pic of the perpetrator.

When turned off, the laptop can't send tracking info, but as soon as it's turned on you'll get a report. While GadgetTrak does not appear in the Windows Start menu or in the system tray, it can be seen in the Uninstall Programs window—though you need an admin password to remove it.

VERDICT 7

GadgetTrak

$20/year, www.gadgettrak.com

LOJACK

The master of tracking—almost

LOJACK IS definitely focused on home users. This is evident not only in the easy and simple installation, but also in the onscreen pop-ups. Designed to be reassuring—with reminders that your laptop is protected—they are no less annoying than any other pop-ups. Luckily, the program is very good at what it does.

Once installed, you need to create an account on the LoJack website, enable geolocation tracking, and create a PIN. A map view shows your device's location and there are four tabs that divvy up the planned recovery of your device: Locate, Lock, Delete, and Recover.

While many services rely on Google Maps, LoJack opts for a map powered by Esri. It looks good but there's no easy way to zoom in to get a more specific idea of where your device is, just a big red dot that, for us, covered quite a large swath of land. Above the map, there's a Device Status indicator that should update itself every 24 hours, so you know that LoJack is still installed.

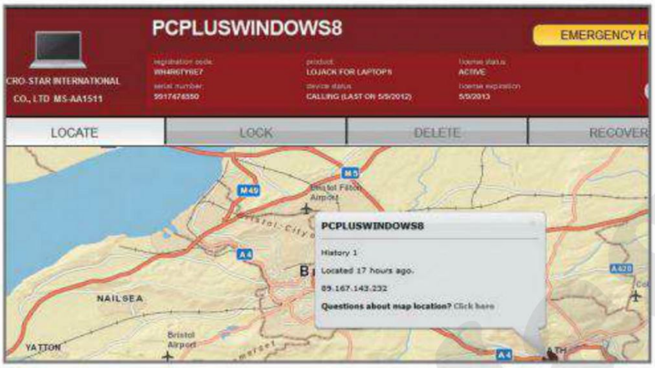
The Lock part of the process requires you to input your PIN, enter a message, then click Lock Device. The locking process isn't instant—it took about 20 minutes for us. When it did lock, we were notified by email. While useful, the locking software isn't entirely secure, but there's also support for Intel hardware locking (if your device supports it).

Remote deletion of your important data is run in the Delete section; in the Recover section, the laptop can be marked as stolen and a Recovery Team is notified and will begin collecting evidence to hand over to the police.

Indeed, despite its minor weaknesses, we felt confident that LoJack had us covered

FEATURES

Geolocation, customized lock-out message, remote lock, remote delete, Theft Recovery Team



PCPLUSWINDOWS8

CRO-STAR INTERNATIONAL CO., LTD MS-AA1511

product: LOJACK FOR LAPTOPS

license status: ACTIVE

device status: CALLING (LAST ON 5/5/2012)

license expiration: 5/5/2013

PCPLUSWINDOWS8

History 1

Located 17 hours ago.

89.167.143.232

Questions about map location? Click here

The Esri mapping system that LoJack uses is less nuanced than Google Maps.

VERDICT 9 KICK ASS!

LoJack

$40/year, www.absolute.com/lojackforlaptops

PREY

An open-source protector of your PC

AS WE SAW with FrontDoorSoftware, Prey proves that just because a product is free doesn't mean it's lacking in features. Indeed, this is a feature-rich and stable open-source program, and evidence that there are a lot of very talented coders out there.

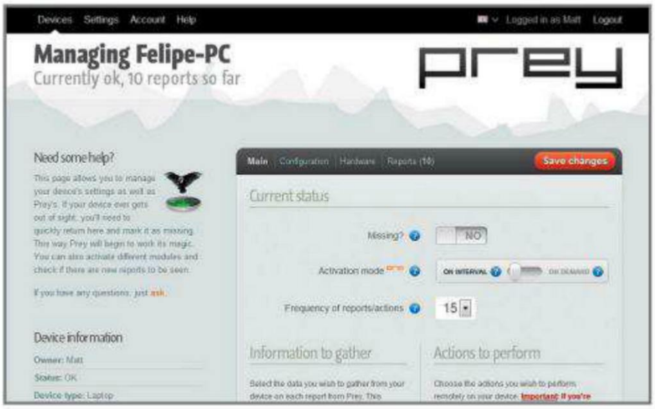
First impressions of Prey are that it has a professional and good-looking interface that manages to easily eclipse FrontDoorSoftware. When launching the software for the first time, you're required to set up how Prey sends you reports—either by email and web, or email only.

The web control panel is excellent, with a clear and attractive interface. Settings can be easily configured via sliding toggles, similar to those found on iOS devices. Designating your laptop as "Lost" will instruct Prey to begin creating reports on its location and send you email notifications. The frequency of these reports and emails can be altered easily, which makes the absence of this capability in GadgetTrak all the more baffling. What GadgetTrak does have over Prey, however, is that GT's reports are included in the email notifications, while Prey only offers a website link.

The reports themselves are very good, though, with Wi-Fi-based location (again pretty accurate), and webcam support. A very handy feature not found in many other laptop security suites is that Prey also takes a screenshot of the laptop. It's a great addition, and if you're lucky, the thief could be on a site that will help with identification, such as Facebook. There's even more information included in the reports, which makes Prey easily one of the best laptop security applications we've tested. And it's free.

FEATURES

Wi-Fi auto-connect, GPS and Wi-Fi geolocation, small memory footprint, webcam and screenshot capture, remote data removal, remote lockdown



Managing Felipe-PC
Currently ok, 10 reports so far

Need some help?
This page allows you to manage your device's settings as well as Prey's. If your device ever gets out of sight, you'll need to quickly return here and mark it as missing. This way Prey will begin to work its magic. You can also activate different modules and check if there are new reports to be seen.
If you have any questions, just ask.

Device information
Owner: Matt
Status: OK
Device type: Laptop

Current status
Missing? NO
Activation mode: ON INTERVAL / ON DEMAND
Frequency of reports/actions: 15

Information to gather
Select the data you wish to gather from your device on each report from Prey. This

Actions to perform
Choose the actions you wish to perform remotely on your device. Important: If you're

Prey lets you determine the frequency at which the program mails you reports on a lost or stolen device.

VERDICT 9

Prey

Free, http://preyproject.com

MYLAPTOPGPS

Uses IP and not GPS for tracking

ONCE YOU'VE set up a MyLaptopGPS account and installed the software, it will run silently, so thieves will have no idea that your laptop is being tracked. As with the other products we've reviewed here, you can track your laptop via an Internet browser.

The interface is rather bland and lacks the friendly style of Prey, but it's easy to navigate. You can quickly designate the laptop as stolen, which turns on tracking and a few unique features. You'll receive email updates about your laptop, with a reassurance that the "SafeRecovery Team is pursuing the recovery of this machine." Also, a window will pop up on the laptop claiming, "This machine is globally tracked via permanently embedded GPS."

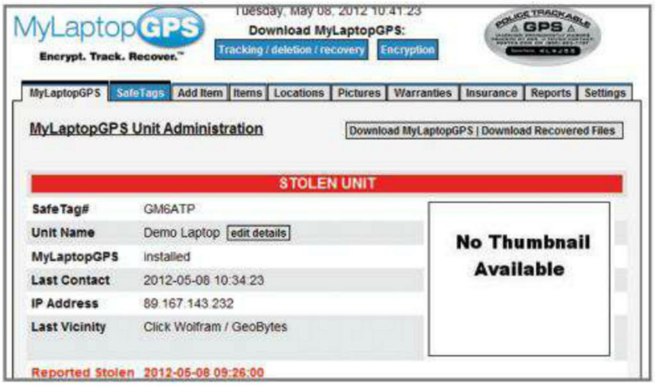
While this message lapses into hyperbole, it could encourage thieves to abandon or even turn over the laptop. There's even a phone number to contact. The window sits on top of other windows, which could also prove annoying for thieves—except that it can be closed easily through the task manager. Once closed, any thief would know the device is being tracked and reinstall the OS.

MyLaptopGPS offers a workaround of sorts. You can identify important files you don't want to lose and when you flag your laptop as stolen, MyLaptopGPS uploads those files to a location on the web, emails you a link, and then deletes them from the laptop.

Though MyLaptopGPS has GPS in the name, it relies on the much less accurate IP address registration to locate laptops. Where other services use Wi-Fi positioning to get a more accurate location, the IP address registrant just gave us the city of the IP address—which wasn't even the city the laptop was in.

FEATURES

IP location tracking, remote data recovery, remote delete



Tuesday, May 08, 2012 10:41:23

MyLaptopGPS Unit Administration

STOLEN UNIT

SafeTag# GM6ATP
Unit Name Demo Laptop
MyLaptopGPS installed
Last Contact 2012-05-08 10:34:23
IP Address 89.167.143.232
Last Vicinity Click Wolfram / GeoBytes

No Thumbnail Available

Reported Stolen 2012-05-08 09:26:00

Once you've identified your laptop as stolen, a message will pop up letting the thieves know they are being tracked.

VERDICT 8

MyLaptopGPS

$10/month, http://mylaptopgps.com

THE LAPTOPLOCK

Free package offers solid basis for security

LAPTOPLOCK IS a free offering that eschews a fancy interface for a simple, no-frills look. Signing up for the service is quick—you simply need to enter your email address and a password, and you're taken straight to the online control panel. From there you can add a computer, giving it a name for easy reference, then download the software. During installation you can choose whether or not to show a splash screen when the laptop starts up—it's nice that you're given the choice.

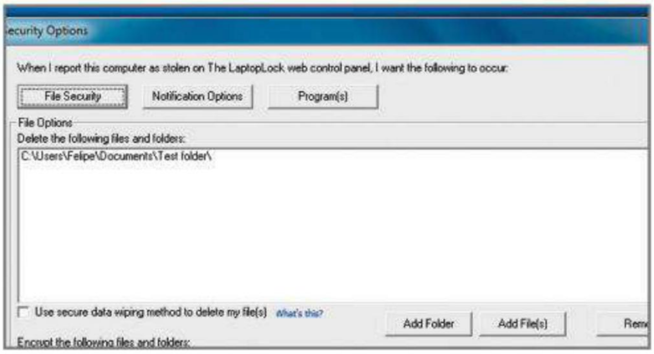
There are no tracking features with this program, so ideally it should be installed alongside a free service that does that, such as Prey. What LaptopLock concentrates on is protecting your data if your laptop is lost or stolen. It does this in three parts. The first part is file security: You can select files you want LaptopLock to delete if you flag your laptop as stolen via the web interface. Choosing the files and folders is very easy, and you can select to securely delete the data, so that data recovery tools can't access it. If you're not too keen on the scorched-earth policy, you can choose to encrypt the files instead.

The second part is notifications: You can choose to show a message or play a sound when the missing laptop is in use. The final part is that you can select a program to launch when the laptop is reported stolen—a good opportunity to run a tracking program, or activate your webcam and upload the photos it takes. The laptop can also be marked as stolen, notifying a recovery team that will begin collecting evidence to hand over to the police.

LaptopLock may appear simple, but with it you can make your own laptop security solution.

FEATURES

Remote delete, remote encrypt, show a message to the user, execute a program, play a sound, visible or hidden from user


ecurity Options
File Security
Notification Options
Program(s)
File Options
What's this?
Add Folder
Add File(s)
Rem

When I report this computer as stolen on The LaptopLock web control panel, I want the following to occur:

Delete the following files and folders:

C:\Users\Felipe\Documents\Test folder\

☐ Use secure data wiping method to delete my file(s)

Encrypt the following files and folders:

With an emphasis on data protection, LaptopLock lets you designate files and folders for deletion or encryption in case of theft.

VERDICT 8

The LaptopLock

Free, www.thelaptoplock.com

MYLAPTOPTRACKER

Stealthily keeps tabs on your machine

INSTALLATION OF MyLaptopTracker is very easy, with just a simple download and install of the software. You're then taken to a web page with a big bright Start Tracking button. Once initiated, you can leave it to track your laptop quietly. There's no sign that MyLaptopTracker has been installed on your laptop; even the Uninstall Programs window shows no trace of it. In fact, the only way to get to MyLaptopTracker on the laptop you want to protect is by opening the Run command window and typing **mydevicetracker**.

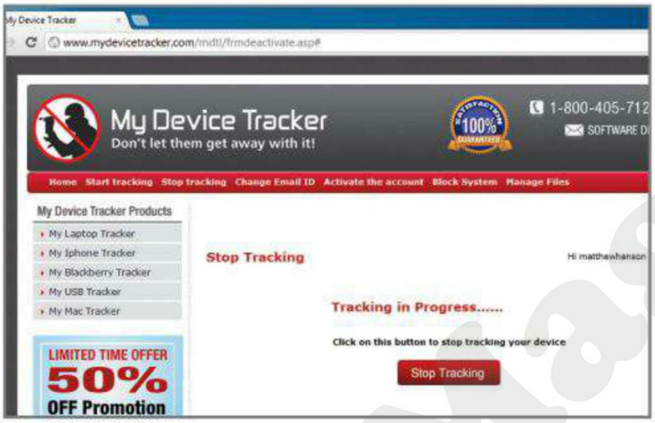
Once in the program, you can select a number of neat features, such as a folder with important personal files that you can hide or, in case of theft, delete. You can also trigger this action if the laptop can't connect to the Internet after a set amount of days—though there are obvious drawbacks to this.

Two welcome features are the ability to alter the time between email notifications and to upload images taken with the laptop's camera to a Flickr or ImageShack account.

The interface for the desktop program is clear and easy to understand and took us very little time to set up, but the web interface is rather sparse. There's no denying that the simplicity of turning tracking on and off via a single button is nice, but the limited web interface can end up being rather annoying as you wait anxiously for a report.

FEATURES

Stealth mode, one-click tracking, Wi-Fi positioning, webcam image capture and Flickr integration, remote data retrieval


My Device Tracker
www.mydevicetracker.com/mdtl/frmdeactivate.asp#
My Device Tracker
Don't let them get away with it!
100%
1-800-405-712
SOFTWARE D
Home
Start tracking
Stop tracking
Change Email ID
Activate the account
Block System
Manage Files
My Device Tracker Products
My Laptop Tracker
My Iphone Tracker
My Blackberry Tracker
My USB Tracker
My Mac Tracker
LIMITED TIME OFFER
50%
OFF Promotion
Stop Tracking
Hi matthewhanson
Stop Tracking

Tracking in Progress......

Click on this button to stop tracking your device

By remaining hidden from view, MyLaptopTracker won't tip off a thief that he or she is being watched.

VERDICT 7

MyLaptopTracker

$30, www.mydevicetracker.com

worldmags

TRACKING SOFTWARE COMPARED

	EX05	FrontDoor Software	GadgetTrak	LoJack	Prey	MyLaptopGPS	The LaptopLock	My LaptopTracker
Price	$495/3 yrs	Free, or $30/3 yrs	$20/yr	$40/yr	Free	$10/mo	Free	$30
Wi-Fi Positioning	Yes	Yes	Yes	Yes	Yes	No	No	Yes
Webcam Support	No	No	Yes	No	Yes	No	No	Yes
Online Dashboard	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Email Reports	Yes	No	Yes	Yes	Yes	Yes	No	Yes
Send Custom Messages	No	Yes	No	Yes	Yes	No	Yes	Yes
Remote Data Wipe	Yes	No	No	Yes	Yes	Yes	Yes	Yes
Remote Lock	Yes	Yes	No	Yes	Yes	No	Yes	No

THE TRACKING CHAMPS

HOPEFULLY, BY READING through this roundup and learning about all the many tracking features that are available, your interest in setting up some proper security measures for your prized devices has been piqued. Besides, you don't want to miss out on posting screenshots of a thief online.

Sometimes in a roundup that includes both free and paid-for software there can be a huge gulf in quality between the two. But sometimes we see free products that offer just as many features—and perform just as well—as their competitors that charge. This is one of those roundups where the free, open-source Prey easily competes with—and in some cases surpasses—its paid-for rivals.

If you were to take a quick look at Prey, you wouldn't think it was a free tool at all. It boasts loads of features, looks great, and works extremely well. Once again, the open-source community has shown that talent and passion can turn an altruistic project into something truly special. With so many features, Prey is the best value laptop security package around.

When a free program does such a good job, it can often feel like a bit of an open-and-shut case—after all, why pay for something when a freebie will do the trick? The results were not so clear cut, though, as LoJack still offers a compelling reason to lay down some cash. LoJack's easy-to-navigate interface, along with the way it splits the laptop security and recovery process into four steps, make it a quick and reassuring tool to use. While there are free services out there, the subscription you pay for LoJack offers peace of mind that the service will still be there when you need it. Dedicated support and recovery are on hand to help you, as well.

> “OPEN-SOURCE PREY EASILY COMPETES WITH—AND IN SOME CASES SURPASSES—ITS PAID-FOR RIVALS

So, in the end, there are two clear tracking-software winners: LoJack representing the paid-for software and Prey winning the free software choice.

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MAXIMUMPC
WINDOWS 8 IS HERE
DREAM MACHINE 2012
OPERATIO
UPGRA

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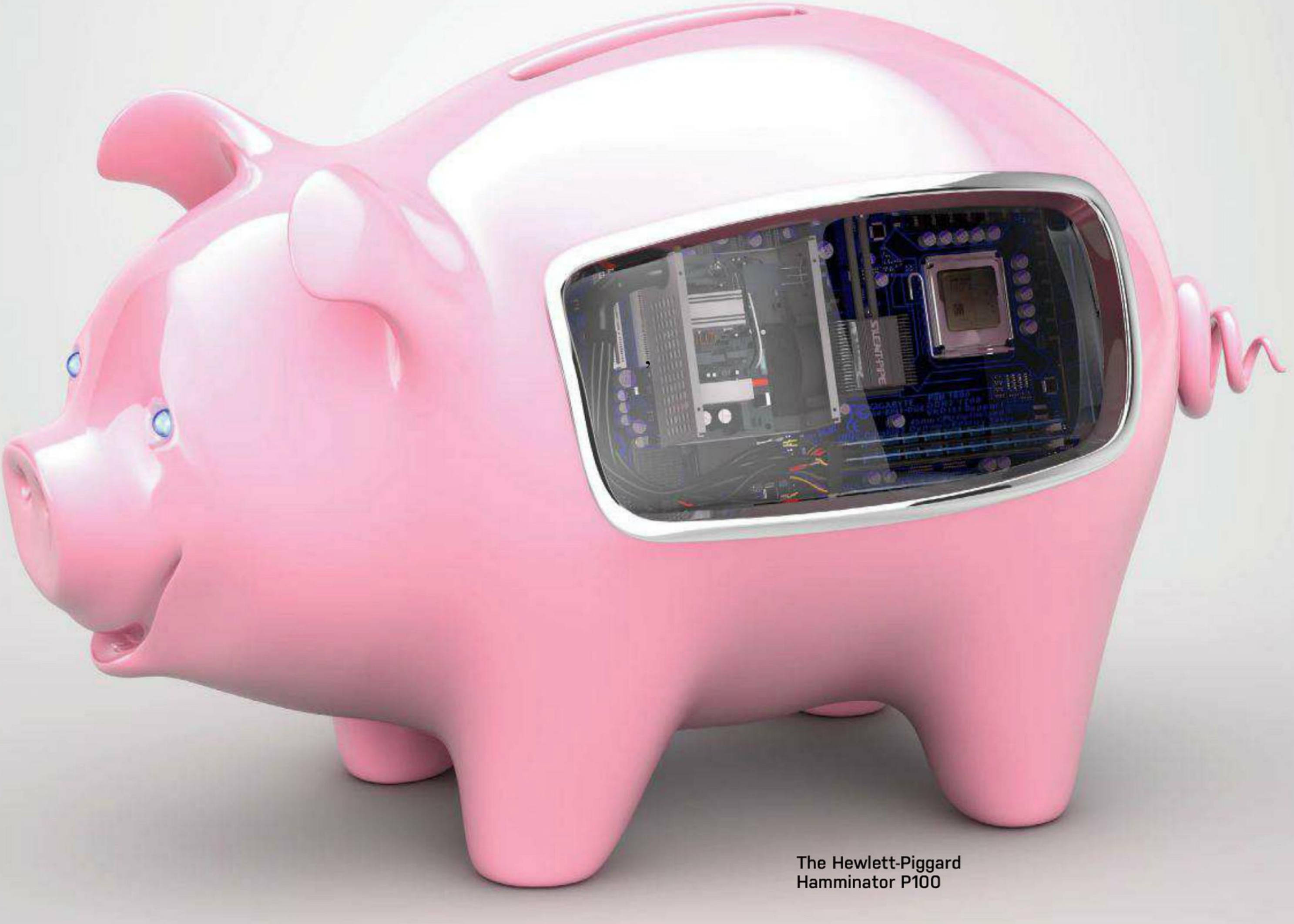


The Hewlett-Piggard
Hamminator P100

COMPUTING ON THE CHEAP

BY THE MAXIMUM PC STAFF, ALEX CASTLE, BRAD CHACOS, AND PAUL LILLY

IT (LITERALLY) PAYS TO KNOW ALL THE CRAFTY WAYS YOU CAN SAVE MONEY WITHOUT SACRIFICING YOUR POWER USER CRED

AS MUCH AS WE LOVE ogling top-of-the-line PC hardware and fantasizing about price-be-damned rigs, we also love, love, love to stretch a dollar. Does that make us cheapskates? You betcha, if that's what you want to call someone who doesn't pay a premium when he or she doesn't have to. Sign us up! In fact, where computing is concerned, knowing all the various angles to save a buck—a buck that can then be put toward new and better gear, mind you—is as much a part of being a power user as knowing how to flash a BIOS or overclock RAM. If you're currently spending top dollar on your PC activities, it's time you got schooled in the fine art of penny-pinching. From free software alternatives, to the best deals on all forms of digital entertainment, to hardware-buying tips, to our blueprint for a $600 PC, this year's Cheapskate's Guide can save you thousands of dollars and make you a more savvy consumer in the process.

SAVE ON SOFTWARE

WHY PLUNK DOWN CASH WHEN YOU CAN HAVE THESE OUTSTANDING FREE ALTERNATIVES?

The sad truth about building a PC is that you never end up sticking to your budget. Even if you manage to resist the temptation to splurge on an extra SSD, you're going to hit the point where your brand-new system is assembled and ready for action—just as soon as you buy some software. First you shell out for the operating system, then some office software, then a security suite. Before you know it, your budget is ancient history and you're taking out a second mortgage to pay for Photoshop.

Well, it doesn't have to be that way. Here are some excellent free software options that can take the place of pricey commercial applications.

AV: **MICROSOFT SECURITY ESSENTIALS**

It's getting harder and harder to justify paying for an antivirus suite, now that Microsoft offers its own capable AV solution. Microsoft Security Essentials provides real-time system scanning, Windows Firewall integration, and rootkit protection, all for the unbeatable price of zero dollars. We say slap it on any new system, and leave paying for AV to the idle rich. http://windows.microsoft.com/MSE

FILE BACKUP: **SYNCBACK FREEWARE**

You know all those photos you have on your hard drive? Priceless reminders of family vacations and childhood memories? Well, it would be a real shame if something happened to them.

No, we're not trying to shake you down—this is just a reminder that you should be using software to automatically back up any file you're not prepared to lose. SyncBack Freeware is a great choice for backing up and synchronizing your valuable files, automatically. If you want to go a step further and clone your whole drive, our standing recommendation is Macrium Reflect (www.macrium.com/reflectfree.aspx). www.2brightsparks.com/syncback/index.html

OFFICE SUITE: **GOOGLE DOCS**

In the past we've recommended Open Office (or its descendant, LibreOffice) as the best free replacement for Microsoft Office, but we think it's time for a change. Let's all admit to ourselves that much of what we currently do using software on our hard drives will, in the next few years, move over to the cloud. Office software has been some of the first to make the transition, and nowadays there's no reason you can't use Google Docs as your everyday productivity software.

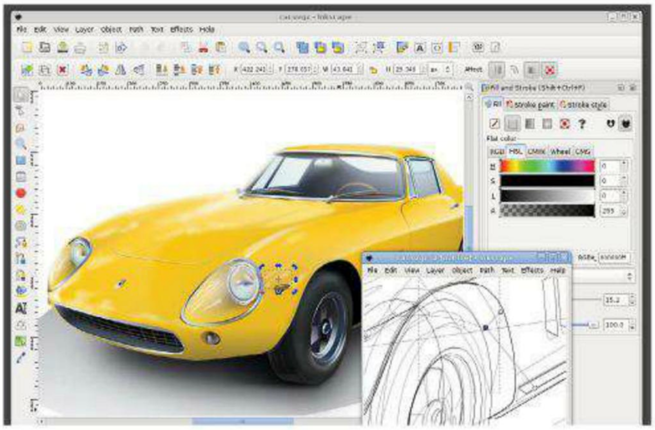
Google Docs can create and edit documents, spreadsheets, presentations, and forms. It's also a great way to collaborate remotely, as multiple people can log in and work on shared documents simultaneously. http://docs.google.com

PHOTO EDITOR: **GIMP**

There's still only one truly good replacement for Adobe's versatile-yet-oh-so-expensive Photoshop, and that's GIMP. The Gnu Image Processor (for long) is open source, free, and has all the tools you need to spruce up your photos, do a little image manipulation, or add some LOLtext to a picture of a cat. If the built-in features aren't enough for you, there's an extensive library of scripts and add-ons available online that should provide what you need. www.gimp.org

VECTOR EDITOR: **INKSCAPE**

GIMP can help you with any raster (that is, pixel-based) editing you do, but it's no good for creating vector-based images. Vector images, which can be smoothly scaled to any size, are the perfect format for company logos or any other illustration that you want to be able to use over and over again. Adobe Illustrator is the standard application for vector editing, but like all professional Adobe software, it's very expensive. Instead, take a look at Inkscape. Inkscape is yet another product of the open-source scene, and it has all the tools you need to create great-looking, high-quality vector graphics. http://inkscape.org



DESKTOP PUBLISHING: **SCRIBUS**

Finishing off the trifecta of open-source design apps is Scribus, which lets you take all those graphics you've created in GIMP and Inkscape (along with any text you've written in Google Docs), and lay them out on a page for publishing. Whether you're putting together an e-book, a magazine, or just the family newsletter, a desktop publishing app like Scribus is the best way to create a professional layout that you can reuse whenever you want. www.scribus.net

ADOBE SOFTWARE FOR $30

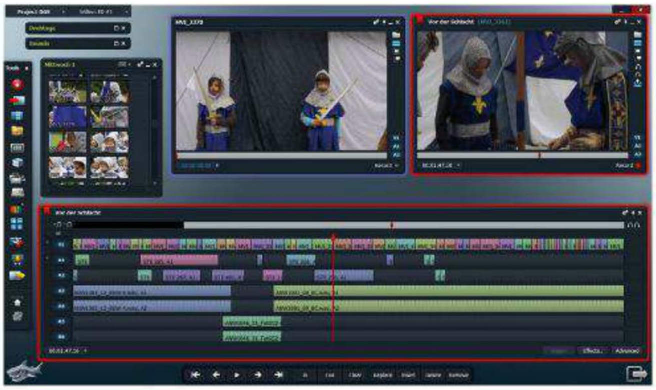
If you're a creative professional, you know that Adobe programs like Photoshop, Illustrator, and Premiere are the industry standard for a reason. They are streamlined, well documented, and incredibly powerful. They are also, unfortunately, incredibly expensive. There's an inexpensive Elements version of Photoshop and Premiere available, but if you need access to the professional-level Creative Suite for personal projects or freelance work, you could be out $1,000 or more in startup costs. Or, you could spend $30.

Starting this year, Adobe is offering full versions of all its Creative Suite software on a rental basis, so if you need Photoshop for a certain project, you can simply rent it for $30 a month with a one-year subscription. If you're sad that you don't get to keep it when you're done, just pop a bottle of champagne and console yourself by rolling around in all the money you saved.

VIDEO EDITING: **LIGHTWORKS**

For a long time, nonlinear video editing software was something you just couldn't really get for free. Microsoft's Windows Live Movie Maker is free, and can be a good option for very basic video editing tasks, but if you're looking to put together anything more complicated than a simple home video, it just doesn't have the feature set you'll need. Other than that, you're pretty much out of luck. There's Blender, which is free and actually has a fairly powerful sequencer, but something just feels off about doing our video editing in a 3D-modeling application. There have also been a number of high-quality open-source video editors in Linux, but those haven't been of any help in Windows. Until now, that is.

Earlier this year, professional video editing software Lightworks went open source, and released a free version for Windows. The software was formerly a professional film-editing suite (*The King's Speech, The Departed,* and *Braveheart* are just a few films that were edited in Lightworks), and therefore has a pretty steep learning curve. Additionally, only a handful of codecs are supported for importing footage, unless you upgrade to the Pro version, which is offered for only $60. Even with those caveats, Lightworks is hands-down the most powerful video editing suite you can get for free. www.lwks.com



DVD PLAYBACK: **VLC**

If you bought an optical drive to play movies, but don't have a copy of playback software like Cyberlink PowerDVD, you might think you're out of luck. But don't take out your wallet just yet—if all you need is bare-bones video playback, VLC might be just right for you. The free, open-source player can handle pretty much any digital video file, as well as video DVDs. Blu-ray playback is also possible in VLC, although you'll need to do a little Googling if you want to watch copy-protected discs. www.videolan.org/vlc/index.html

OPERATING SYSTEM: **UBUNTU**

If you've gotten this far in your hunt for free software, it might be time to think about going all the way. That's right—the ultimate in free computing: Linux. Nearly every program mentioned so far started as a Linux application before being ported to Windows, and there are still more free software packages that aren't available on Microsoft's OS.

If you're ready to get started with Linux, you'll want to create an Ubuntu Live CD from the website. Ubuntu's the most user-friendly Linux distro, and the easiest to get started with. Once you've downloaded the installer, just burn it to a CD, put the disc in your drive, and restart. When your computer boots from the live CD, you'll be able to try out Ubuntu and see how you like it. If you want to go all the way, you can install the full operating system to your hard disc.

Linux is great for productivity applications, but it doesn't always have an equivalent for your favorite Windows applications. You can use WINE (www.winehq.org) in Linux to run most Windows applications natively. www.ubuntu.com/download/desktop

FREE CLOUD STORAGE

Cloud storage solutions are cheaper and more numerous than ever before, with several contenders just begging to give you something for nothing. But what if one service and 5GB isn't enough for your vast collection of J-Pop and Klingon poetry? Pay attention, young Padawan: We'll show you how to get the biggest bang from your lack of bucks when choosing a free cloud service.

Microsoft SkyDrive - Old-skool SkyDrivers are sitting pretty on 25GB of free cloud storage, but new users are "limited" to 7GB. Even so, that's more than the competition offers, and SkyDrive hooks deeply into the native apps found in both Windows Phones and Windows 8. SkyDrive lacks Android support, but it's the only cloud-storage service here with a Windows Phone app.

Google Drive - Google Drive offers 5GB of free storage and the same basic functionality as SkyDrive, including the ability to edit documents with others in real time through your web browser. We prefer Google Docs to Microsoft's Office Web Apps, though, which makes Google Drive a great place to stash documents, spreadsheets, and slide shows.

SugarSync - SugarSync adds another 5GB of free cloud storage to your total, but more importantly, it syncs any folders of your choosing on your PC. The desktop clients of the other services mentioned here force you to stash your files in a predetermined location. That makes SugarSync a terrific option for a hands-off, constantly updated backup of critical folders, such as your Documents folder.

Dropbox - At first blush, Dropbox's free 2GB offer pales in comparison to the others, but a little legwork opens up a bountiful cornucopia of free storage. Using the Camera Upload feature and linking social media accounts earn you more space, but the big payoff comes in referring friends: Each referral gets you another 500MB, capped at a whopping 16GB of free additional space. Don't want to bug your pals? We've already explained how to game the system (bit.ly/exLt1r).

Add it all up and that's 22GB of free cloud storage. Plus, Dropbox doesn't impose size restrictions on files uploaded via the desktop client. It's ideal for large file dumps.

Box - Box is just a 5GB storage locker; it doesn't sync files, search text, or offer version histories. What it does do is frequently hold promotions for 50GB of free space. Through the end of 2012, if you sign into Box's app on a PlayBook, TouchPad, LG phone or tablet, or a Sony tablet or Xperia phone, you'll nab an additional 50GB for life. Files are still limited to 100MB in size, though. ADrive offers 50GB free without all the hoop-jumping, but its craptastic web-only interface and lack of mobile support make it more hassle than hurrah.

Grand Total: 44GB, or 119GB if you're a veteran SkyDrive user who hops on Box's 50GB offer. Not too shabby for nothing! Protip: With the exception of SugarSync, disable the services' desktop clients from running at startup to avoid needlessly tying up system resources.

F2P IS FTW

A GROWING NUMBER OF TRULY GOOD FREE-TO-PLAY GAMES HAS US GIDDY

The biggest story in gaming over the last few years has been the rise of the "free-to-play" business model, where publishers let gamers access the core game for free, then turn a profit off of optional microtransactions. There are just about a million F2P games available today, but only some of them are worth your time. Here are eight games that can be really, truly fun even if you don't pay a single penny.

TEAM FORTRESS 2

Valve's flagship team-based shooter went free-to-play just over a year ago, and it has become the perfect example of how to implement the business model. For the low, low price of absolutely nothing, you get the full game, with all characters and all maps. Any server, any game mode. Extra weapons allow for different play styles, but don't give an advantage, and can be unlocked without paying anything, if you're patient. If you've gone this long without playing Team Fortress 2, you're missing out—download it today. www.tf2.com

LEAGUE OF LEGENDS

You've probably heard of League of Legends. It's the biggest name in the new MOBA (multiplayer online battle arena) genre, and its growth has been nothing short of phenomenal. Recent usage figures from XFire show League of Legends as the most-played online PC game. Period. *By a wide margin.* So what's the secret to LoL's success? Our money is on the extreme ease with which you can get into the game. At any given time, a balanced subset of the game's roster of 100-plus champions is available for free, and more champions can be unlocked by winning games. The competition's fierce, but you can go all the way to the top without spending any money. http://na.leagueoflegends.com

EVERQUEST 2

These days, if you look at the total number of MMORPGs, you'll find that at least 80 percent offer some sort of free-to-play option. Of these, there are two very distinct varieties. On one hand, you've got a vast expanse of same-ish Korean and Chinese MMOs with pretty graphics, grindy gameplay, and extortionist microtransactions. On the other, there's the Western MMO-in-decline—games that once used a traditional subscription business model, but have switched to free-to-play after subscriber numbers dwindled. Everquest 2 is a great example of the latter, with a generous free option (including the original game and six expansion packs), plus a monthly subscription model for those who want full access. www.everquest2.com

VINDICTUS

Nexon is the Korean publisher behind a slew of free-to-play games, including eight currently running MMOs in America and tons more overseas. Of all these, we recommend Vindictus as the best Asian-style MMO for a Western audience. It's still a bit of a grind, but the combat is fun and fast-paced, and the dark, gritty graphics are absolutely gorgeous. http://vindictus.nexon.net/

COMBAT ARMS

If you're dying for a team-based modern military shooter, but don't want to shell out for the latest Call of Duty game, give Combat Arms a try. With CounterStrike-style action gameplay and a host of character and weapon customization options, this game should hold you over at least until Crytek's Warface is released in the states. One downside: Combat Arms uses the stingy microtransaction model favored by some Asian F2P games, where most items not purchased with real money disappear from your inventory after a set period of time. Our philosophy: If you work to buy something, you should get to keep it. http://combatarms.nexon.net/

TRIBES: ASCEND

Who wasn't a little surprised when the classic Tribes franchise was relaunched with the free-to-play Ascend? The game's multiplayer-centric nature makes it a good fit, and the free version has every bit as much running, flying, and exploding-disc-launching as any game in the series. Some important gear and classes have to be unlocked, and gaining experience is slow going without paying money, but it is perfectly possible to enjoy the game for a long time without paying anything. https://account.hirezstudios.com/tribesascend/

m031 has dropped enemy flag

AGE OF EMPIRES ONLINE

Age of Empires Online continues the trend of nearly forgotten, revered gaming franchises coming back as F2P games. The cartoony graphics might make you think that this is a watered-down casual, but the truth is that AoE Online is a full-featured, robust online RTS with great gameplay and a ton of customization options. You can play the full game with two of the four available civilizations for free, though you'll have to pay for extra civs and some advanced gameplay features. www.ageofempiresonline.com

WORLD OF TANKS

If you're looking for a more tactical take on the action genre, check out World of Tanks. By participating in team-based tank battles, you level up your crew and unlock and customize ever-stronger WWII fighting machines. It's hard to get to the very highest level of tank without purchasing an XP booster, but the gameplay is polished enough that even the low- and mid-level battles are a ton of fun. http://worldoftanks.com/

BEST OF ONLINE MUSIC

Buying songs through iTunes or Google's Play Store won't break the bank, but true cheapskates spin their songs using streaming music services. Anyone with an Internet connection and the willingness to endure a few ads can listen to millions of tracks for the low, low price of $0. Streaming music services are a dime a dozen these days; here are four that let you listen to the tunes you want, when you want them—in unlimited quantities—for even less than that.

SPOTIFY

Wait, isn't Spotify a premium streaming music service? Yep, but free subscribers can tap into all of Spotify's offerings in the desktop client, including the ability to make and share playlists or listen to any of the 16 million-plus songs in Spotify's catalog on-demand. The software even integrates songs stored on your local drives.

Recommended

STRONG SUITS

- Massive catalog of on-demand music
- Making playlists is easy
- Optional apps add a lot of features and functionality

WEAK POINTS

- Facebook login is required
- Lackluster radio stations
- Mobile listening is iOS-only and limited to lamesauce radio

GROOVESHARK

Grooveshark's user-uploaded tunes give it a gargantuan catalog with hit-or-miss audio quality and a dubious, lawsuit-luring legal footing that has already caused Grooveshark's apps to be yanked from all the major app stores. There are ton of different ways to find and listen to music, though. Unfortunately, the interface is fairly horrible.

STRONG SUITS

- Huge music catalog
- Includes unlimited on-demand, radio, playlist, and social listening options
- Upload your music collection to Grooveshark's servers, then stream it anywhere

WEAK POINTS

- Legal issues could close the service
- Variable audio quality
- No sanctioned mobile apps for major brands; must sideload apps from the Grooveshark website
- Free listeners limited to radio functionality on mobile devices
- Fugly, clunky interface

SLACKER RADIO

Slacker doesn't offer on-demand listening to freeloaders, only radio-style listening, but its library is 10 million-plus songs strong and the 200-plus stations are all curated by actual DJs for maximum awesomeness. Plus, freebie listeners get the same device support as paid subscribers, including mobile apps and home audio devices like Sonos, Sony electronics, and the Logitech Squeezebox. Yay!

STRONG SUITS

- Large song catalog
- DJ-curated radio stations
- Full device support for free listeners
- Polished, attractive interface

WEAK POINTS

- Smaller library than Spotify or Grooveshark
- Playlists and on-demand listening for premium subscribers only
- No rewinding and limited song skipping

TURNTABLE.FM

Turntable.fm shines by tickling your social bone. Up to five DJs take turns spinning songs for a "room," either using Turntable.fm's licensed music or uploading tracks of their own. Other users can hop into the room and listen to what all the fuss is about, up- or down-voting songs all the while. Oh, and did we mention the chat function and awesome customizable cartoon avatars?

STRONG SUITS

- Outstanding social aspects and visual style
- Great for discovering new music
- DJing and customizing avatars is just plain fun
- Dozens of rooms with varying musical themes...

WEAK POINTS

- ...but geez, there are a lot of electro/dubstep rooms
- U.S. only
- Limited licensed song selection
- Users have little say in what music plays

HOW TO GET FREE READS

It's great that e-readers make it possible to tote around a veritable library of books wherever we go. What's not so great is having to pay for all those tomes. Well, guess what? You don't have to. There are several ways you can satisfy your reading jones for free. Project Gutenberg (www.gutenberg.org) offers over 40,000 books in the public domain, giving you a great excuse to brush up on the classics. Free-eBooks.net showcases books by independent writers of both fiction and nonfiction, with Top 10 lists and member voting providing useful guidance. If you're an Amazon Prime member, you're eligible to borrow one e-book a month (with no due dates) from the Kindle Owners' Lending Library, which comprises more than 145,000 titles . And any Kindle owner, regardless of Prime membership, can borrow e-books from their local public library, if it uses the OverDrive system for online checkout. (For more info on this, see our February 2012 How To on the subject or visit www.overdrive.com.)

SAYONARA, CABLE OR SATELLITE

A SURFEIT OF FREE/CHEAP STREAMING OPTIONS HELPS YOU STICK IT TO THE MAN

A true cheapskate realizes that in today's age of low-cost broadband and high-quality video streams, paying $100-plus a month for cable isn't the entertainment necessity it used to be. But before you cut the cord, you need to know where to go to find what you want to watch. Let us be your guide!

First, a word of warning: Some streaming websites walk a gray, unlicensed legal line, offering a ton of very current content, but constantly playing whack-a-mole with copyright enforcement agencies. Malware can be a concern, too. We'll mention a few of the top options; if you choose to surf these gray areas, you do so at your own risk. The same goes for torrents.

Got it? Good! Let's get streaming.

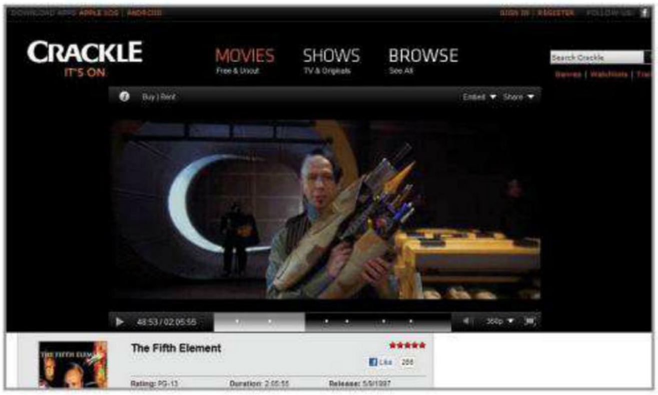
MOVIES

Cinema fans have the most options when it comes to cutting the cord, starting first and foremost with the 800-pound gorilla in the streaming video world: Netflix Watch Instantly. For just $7.99 a month—that's around a quarter a day, if you're counting—you can stream anything from the service's library as often as you want. Finding newer releases is a bit hit-or-miss, but Netflix nevertheless has a tremendously deep movie catalog full of interesting titles, along with robust device support, 720p HD video, and 5.1 surround sound, to boot.

Crackle has also been rocking our socks in recent months. The Sony-owned venture is completely free and jam-packed with over 300 kick-ass movies, with a focus on sci-fi, action, comedy, and horror flicks. Plus, Crackle is available on a ton of devices, including iOS and Android, Sony electronics, Roku, and the Xbox 360. New titles are nonexistent, though, and the SD streams are a bummer during full-screen viewing.

If you're a fan of classic movies, Entertainment Magazine Online (EMOL.org) streams a cornucopia of films made prior to 1970.

CinemaNow, iTunes, and Amazon Instant Video are pricier à la carte options for movie rentals or digital purchases. Spending a fiver on a movie rental doesn't seem too bad, but it can add up quickly over the course of a month. On the plus side, these services carry virtually every title you can think of, with most available in HD.



Crackle's catalog is packed with awesome action, comedy, and genre movies, and it's free.

TV SHOWS

The services discussed in the movie section apply here, too. The à la carte options also sell TV episodes; Crackle is a good source for older sitcoms, original content, and anime; and Netflix Watch Instantly has a ton of television offerings, most notably its wide collection of children's cartoons and documentaries.

Speaking of documentaries, check out DocumentaryStorm.com, a killer site that adds a new documentary every day. Many come embedded from high-quality sources like National Geographic, PBS, TED, and VICE.

Of course, there's always Hulu. Hulu carries several recent television shows, with new episodes often appearing the day after they air on cable. The coverage has gaps, however, and ABC, NBC, Fox, and Comedy Central supply a lot of the content. Numerous older shows are also available. The base version is free, but it forces you to watch shows only on your PC and only in standard definition. Upping to Hulu Plus for $7.99 a month unlocks device support and HD streams. Every flavor contains ads.

TV-Links.eu is one of those questionable "gray area" websites, but it's been around forever and streams a huge selection of shows. We prefer its legal counterpart: Installing an HD TV tuner in your HDTV or HTPC. Add Windows Media Center (or an equivalent) and you've got a free, full-blown DVR solution for your local TV stations.

hulu
TV
Movies
Try Hulu Plus for Free »
Log In
Sign Up
Browse TV
Most Popular
Recently Added
Favorites
Latino
search
FOX

Hulu has a lot of free TV shows, but the SD video quality and numerous ads suck.

SPORTS

Wannabe cord cutters often cite the lack of sports options as part of their reluctance to commit to a cable-free lifestyle. That's not quite true these days: TNT live-streamed more than 40 NBA playoff games last season, while the NFL streams both its Sunday Night Football games and its playoff games.

The big games may be covered, but everyday game coverage is severely lacking, making it difficult for cheapskates to root, root, root for the home team unless you purchase a streaming subscription from your league of choice—and those aren't cheap. Season-long passes for streaming the NBA, MLB, and NHL fall in the $100 to $200 price range depending on the sport and the particular package. The NFL's Game Rewind only costs $40 for the season, but it doesn't stream live games, only full replays that go live the day after the real action takes place.

Once again, an HD TV tuner slapped in an HTPC can nab any signals your local stations broadcast; that's probably the best bet for cord-cutting sports fanatics.

In the ever-present gray area, FirstRow Sports live-streams ESPN and pretty much every live sporting event from around the world. It's also proven remarkably resilient to takedown efforts. In a pinch, you can head to Justin.TV, where people often put up low-quality live streams of their TVs whenever a large sporting event takes place. Just don't act surprised when the MPAA sends you a nasty letter.

HOW TO SAVE ON YOUR CELL PHONE AND BROADBAND BILL

Death, taxes, and bill shock. The first two are unavoidable, but luckily, there are a number of ways to avoid unnecessarily high mobile phone and broadband bills. Starting with the former, it's important to figure out how and when you use your phone. Unlimited talk and texting plans are great for chatterbugs, but if you only whip out your phone for emergencies, don't overpay for headroom you'll never use. Along those same lines, you can reduce your reliance on cell phone minutes by using your landline to make calls, or by using VoIP services like Skype.

Another way to sidestep cell phone charges is by integrating Google Voice into your daily usage habits. Google Voice supports free SMS text messaging to the U.S. and Canada, and you can also make and receive calls without tapping into your cell phone minutes.

Don't let your wireless carrier nickel-and-dime you to death with supplementary add-ons, like premium voice mail, roadside assistance, and other optional features. If you absolutely need the peace of mind that comes from an extended warranty (or were born clumsy), shop around for the best rates and service. SquareTrade is one of the most popular third-party providers of warranties, and you can typically find online coupon codes good for 20 to 30 percent off.

Finally, decide if it's really in your best interest to commit to a long-term contract, especially if you plan on getting a feature phone. Prepaid and pay-as-you go plans can be obtained for as little as $10/month. On the flip side, if a long-term contract is in the cards, utilize strength in numbers by splitting a family plan not just with immediate kin, but with a close friend, co-worker, roommate, or a family member who doesn't live with you. Wireless carriers typically charge $10 to $15 to add a line to a family plan, and if you and a friend split the entire bill, you both can come out ahead.

Saving money on your broadband bill starts the same way: by analyzing your usage habits. The most obvious way to save some coin is to make sure you're not paying for an ultra-fast service tier if all you're doing is roaming the web in search of lolcats and updating your Facebook status. Don't be afraid to downgrade your service to see if a lower speed suits your surfing style.

Bundling your TV, phone, and Internet service can reduce your bill, and it also gives you increased bargaining power. Times are tough all around, and if you call your ISP to cancel your service, they'll usually try to sweeten the deal in some way so that you'll stick around. If not, ask to speak with a supervisor to let them know you're leaving for a cheaper competitor. Of course, you don't have to bluff. Services like Sonic.net offer relatively low-cost broadband-plus-phone service, albeit it's limited to California residents.

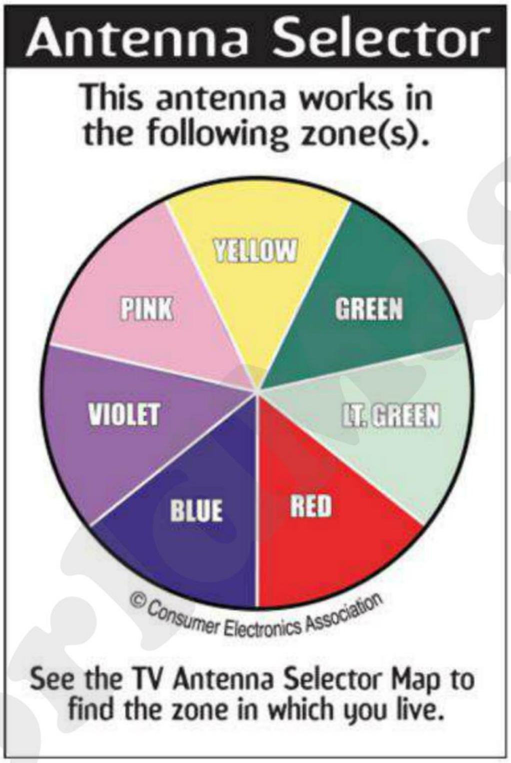
Need more help? BillShrink.com is a great resource to find out if you're overpaying on everyday expenses, including wireless service.

HOW TO GET HDTV FOR FREE

Ever notice how cable and satellite companies only call some channels "pay per view"? Well, the truth is, they're all pay-per-view, aren't they? Not once you cut that satellite or cable in favor of a hybrid streaming/ATSC strategy. ATSC is the fancy way to say free broadcast TV. This usually gets you your local network affiliates with national and local news, as well big event sports such as the World Series or Super Bowl.

To see if you can go this route, first visit AntennaWeb.org and click on the "maximize your television reception" button under the home tab. Punch in your zip code and the web app will present a list of stations, how far away they are, their direction, and more importantly, what level of antenna you need. Since the most difficult part of picking an antenna is knowing what your needs are, many antenna makers now follow the CEA's color-coding. So if the stations you need to hit are nearby, an indoor antenna may suffice. If you're trying to pinch a signal from a station 50 miles away, you may need a directional antenna that can be moved.

The color coding is confusing, but yellow and green are for areas with strong signals, while red and blue are the weakest signals, requiring directional antennas with amplifiers. Decoding the signal is easy if you intend to plug it into any modern HDTV, as each includes ATSC decoders. If you're looking for a PVR-like experience, TiVo boxes will function with ATSC signals, but you will have to pay a monthly service fee or pay up front for the lifetime service. An HTPC with an ATSC tuner will also replicate much of the PVR's ability to record playback.


Antenna Selector
This antenna works in the following zone(s).
YELLOW
PINK
GREEN
VIOLET
LT. GREEN
BLUE
RED
© Consumer Electronics Association
See the TV Antenna Selector Map to find the zone in which you live.

WorldMags

SAVE MONEY ON PC HARDWARE

GREAT DEALS CAN BE HAD, IF YOU KNOW WHERE TO LOOK

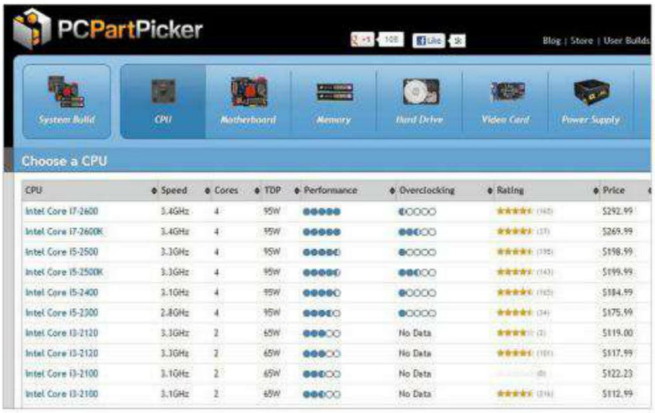
Having a fixed hardware budget doesn't mean you have to sacrifice system specs. By following our handy guide here, you can literally stretch your hardware dollar to get that faster CPU, larger hard drive, or bigger GPU.

DIY MEET BIY: BUY IT YOURSELF

If you haven't already guessed, we love building our own computers—it's as therapeutic as whittling or gardening—but quite often, it's not the best course of action for a penny-pinching cheapskate. That's because you'll never get the break the big boys do. Sure, you might occasionally get a killer deal on a CPU or motherboard that brings the cost down, but since OEMs buy CPUs and motherboards by the boxcar, you can bet they get a far better price on everything, from the CPU to the RAM to the OS. We don't think you should give up, though. One great advantage a do-it-yourselfer has over most OEMs is flexibility. You want X GPU with Y CPU and Z case? Building it yourself gets you that. It just won't be cheaper. If you're doing an ultra-cheap box for your brother-in-law, however, and he doesn't have particular hardware needs, you should first peruse the websites of the OEMs to see if a prebuilt rig with support and warranty is the cheapest route.

USE PCPARTPICKER.COM

PCPartPicker.com does much of the heavy lifting for any cheapskate looking to build a good system. If we actually had the initiative, and we weren't working as roadies on the Speed of Sound Tour six years ago, man, we would have created the cool building tool known as PCPartPicker.com. PCPartPicker.com lets you easily build your new DIY masterpiece by selecting each major component from a list of parts based on the best available price. What we especially like about the site is that it lets you game up configurations on the fly to share with friends for input. Often, PCPartPicker even accounts for shipping and rebates. Want to see how much your build would cost if you bought all the parts from each store? PCPartPicker does that, too. There's even a chart showing the historical fluctuation of the price of a particular part. If you're putting together a new PC, we recommend that you start here.

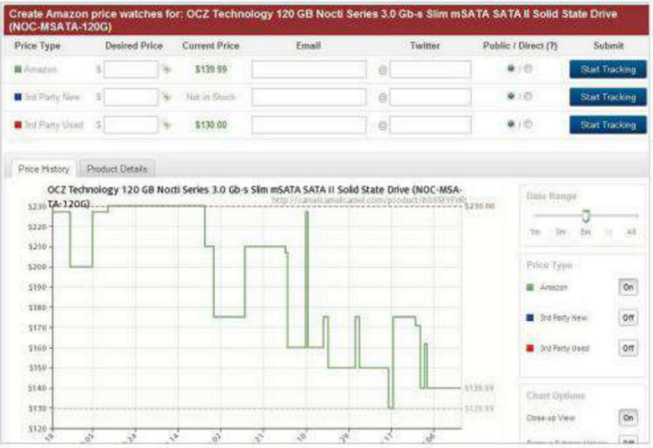


Choose a CPU

CPU	Speed	Cores	TDP	Performance	Overclocking	Rating	Price
Intel Core I7-2600	3.4GHz	4	95W	●●●●●	◐○○○○	★★★★★ (143)	$292.99
Intel Core I7-2600K	3.4GHz	4	95W	●●●●●	●●◐○○	★★★★★ (37)	$269.99
Intel Core I5-2500	3.3GHz	4	95W	●●●●◐	●○○○○	★★★★★ (195)	$198.99
Intel Core I5-2500K	3.3GHz	4	95W	●●●●◐	●●◐○○	★★★★★ (143)	$199.99
Intel Core I5-2400	3.1GHz	4	95W	●●●●◐	●○○○○	★★★★★ (165)	$184.99
Intel Core I5-2300	2.8GHz	4	95W	●●●◐○	●○○○○	★★★★★ (34)	$175.99
Intel Core I3-2120	3.3GHz	2	65W	●●●○○	No Data	★★★★ (3)	$119.00
Intel Core I3-2120	3.3GHz	2	65W	●●●○○	No Data	★★★★★ (101)	$117.99
Intel Core I3-2100	3.1GHz	2	65W	●●◐○○	No Data	(0)	$122.23
Intel Core I3-2100	3.1GHz	2	65W	●●◐○○	No Data	★★★★★ (216)	$112.99

LOOK AT THE RAW INTELLIGENCE

When you're as intimately familiar with a product category's prices as you are with the sandwich toppings at Subway (right?), you instinctively know when you're getting a good deal. But what if you don't follow a category religiously? In those cases, we turn to Camelcamelcamel.com. This site data-mines leading e-tailers such as Amazon.com, BestBuy.com, and Newegg.com and displays the info in a nice, tidy chart. It also gives you the historical high, low, average, and current price and allows you to set alerts for individual items that hit a price before you make your move.



Create Amazon price watches for: OCZ Technology 120 GB Nocti Series 3.0 Gb-s Slim mSATA SATA II Solid State Drive (NOC-MSATA-120G)

Price Type	Desired Price	Current Price	Email	Twitter	Public / Direct (?)	Submit
🟩 Amazon	$	$139.99			● / ○	Start Tracking
🟦 3rd Party New	$	Not in Stock			● / ○	Start Tracking
🟥 3rd Party Used	$	$130.00			● / ○	Start Tracking

A BUNDLE OF SAVINGS?

Part of the joy in building your own PC is the granularity you get in selecting parts. Sometimes you want the motherboard with the green heatsinks instead of the blue ones. When you're in skinflint mode, though, don't overlook the advantage of doing a bundle deal. Many sites—Newegg and Fry's, in particular—offer bundle deals that can save you a good amount of cash. Some bundles combine motherboard with CPU, and others combine all the parts you need to build a PC.

MONITOR THE DEAL SITES

You know what's wrong with deal sites like Slickdeals.net, Fatwallet.com, and Woot.com? They don't save you any money if you have poor self-control. If, however, you have some ability to restrain your impulses, deal sites can yield incredible savings on PC parts.

You'll need to cruise the sites on a regular basis while waiting for the deal you want to come up, but the savings can be significant. Again, the key is that you exercise self-restraint. For instance, we recently bought a five-pack of AV software that we didn't really need simply because it was too cheap to pass up.

CAN WE INTEREST YOU IN A USED PC PART?

An easy way to stretch your dollar is to buy "pre-owned" equipment. There are several tiers of pre-owned. At the top are refurbished parts. Technically, hardware that has been refurbished has been "certified" by the manufacturer before being sold. While refurbs can be defective items that have been repaired, don't assume that's always the case. Sometimes the original buyer may return it out of dissatisfaction, the inability to use it, or a cosmetic flaw, such as a scratch. Legally, manufacturers cannot sell them as new, so the item is "checked out" and then sold as refurbished. These refurbed items can be sold from the manufacturer of the item as well as through retailers. Many refurbished items carry the same warranty as a new item, but in some cases, the warranties may be far shorter—it's up to the buyer to verify that information with the store first. We recommend doing stress testing and putting any refurbed hardware through its paces before the warranty period expires. You don't want to, for example, buy a used videocard and wait 60 days before you power it on. Test it immediately.

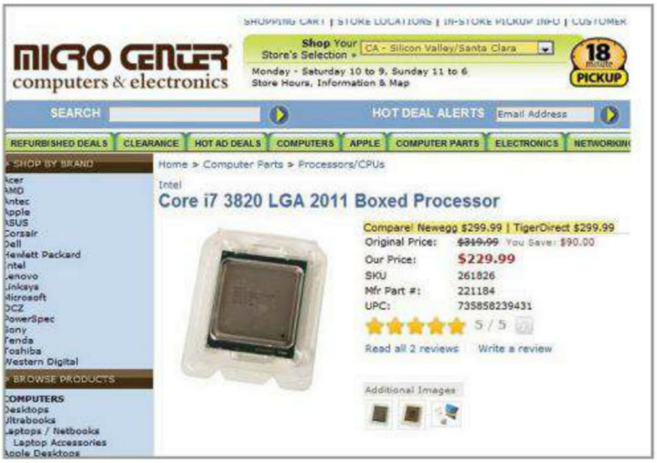
The next tier down is "open box" which is usually sold only by the retailer. Why was it returned? Who knows. Reasons could run the gamut, from it not matching the original purchaser's carpet color, to it being defective out of the box—or it could have been the store demo unit. Open-box items are very much a crapshoot, as the manufacturer hasn't tested it or made sure the power brick was in the box. Because it's so risky, check the store's return policy on the item before you buy, and be crystal clear as to whether it carries a warranty from the manufacturer.

The last category is "used," which means what you think it does. We honestly think that used PC parts have a lot of upsides. Used items are normally marked down the most when sold by stores. If it's a person-to-person sale, the fact that someone was using it means it worked. And unlike a mechanical item with a limited life cycle, a used CPU's life span is typically indistinguishable from a new one, if it hasn't been abused. The greatest risk with buying used is the lack of a warranty and the fact that you don't truly know the history of the part if you're buying it on eBay. Face-to-face transactions through Craigslist.com can be more comforting, until you realize you're meeting a complete stranger with $900 in your pocket. In these situations, we recommend that you meet the person in a café or, if you're really paranoid, the lobby of the police department.

One final tip: Remember to be aware of restocking fees (which some stores charge even for defective items) and who's responsible for shipping if you have to send it back because it's bad: you.

LOOK FOR LOSS LEADERS

A "loss leader" in retail terms is something sold at a slight loss to stimulate some other sale that helps the retailer. This can be deeply discounted hardware on a weekly basis to get people into the stores in the hope they will buy other items. One long-running loss leader few know about is Micro Center's deep cuts on certain CPUs. Intel's Core i7-3770K, for example, will fetch from $330 to $350 elsewhere. But walk into a Micro Center and you can buy a Core i7-3770K for $290. That Core i7-3820 going for $300 outside? Walk into a Micro Center and get it for $229. Sweet, right? The bad news is that you'll have to literally walk into the store, which means you'll have to pay taxes (damn, those roads and freeways that don't build themselves!). And since we don't have any self-control, we usually end up walking out with a bulk spindle of blank DVDs, a new mouse, ink for the printer, and a Diet Coke. D'oh! There go our savings!



Monday - Saturday 10 to 9, Sunday 11 to 6
Store Hours, Information & Map

Home > Computer Parts > Processors/CPUs

Intel

Core i7 3820 LGA 2011 Boxed Processor

Compare! Newegg $299.99 | TigerDirect $299.99

Original Price: ~~$319.99~~ You Save: $90.00

Our Price: $229.99

SKU 261826

Mfr Part #: 221184

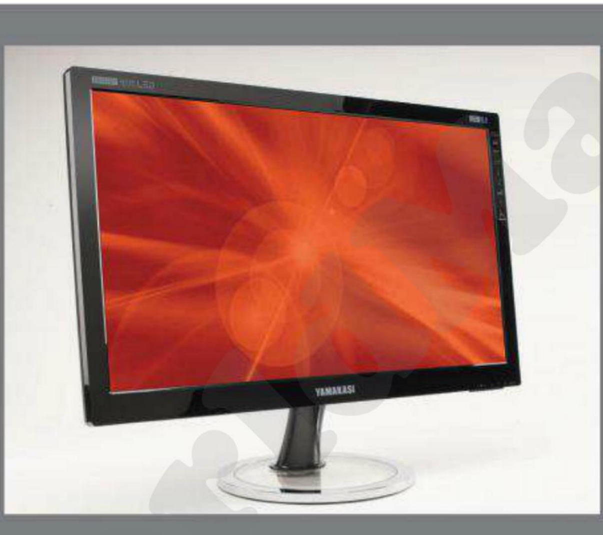
UPC: 735858239431

★★★★★ 5 / 5

Read all 2 reviews Write a review

1440P UNDER $400

The DIY sphere has been a-buzzin' over previously unknown monitors like the Yamasaki Catleap and the Achieva Shimian, which use the same 27-inch 2560x1440 S-IPS panel from LG that's in the 27-inch iMac's Cinema Display. They ship straight from Korea for as little as $350. Why so cheap? They're no-frills, and the panels could contain a few dead pixels. We ordered a Catleap from an eBay seller to check it out. No frills is right: The model we chose has only one input (dual-link DVI), no onscreen display, and a wobbly stand, but the picture is great and there are no discernible dead pixels. Even with the added cost of a sturdy (and reusable) VESA monitor stand, we're still getting a hell of a deal on this panel—though attaching the VESA mount means partially disassembling the monitor.



What it lacks in extras it makes up for in price: the 2560x1440 Yamakasi Catleap is less than $400 new on eBay.

COMMON SAVING STRATEGIES PUT TO THE TEST

Over the years, we've observed PC builders employing all kinds of interesting methods intended to save money or stretch a buck. Let's ponder for a moment whether these strategies actually make sense.

IS ADDING A SECOND CARD LATER EVER WORTH IT?

There's a famous cheapskate maneuver that we'll call the "Multi-Card Gambit," where a consumer buys a midrange $250 GPU with the intention of doubling the performance a year later when the prices of the same card have been cut in half. The problem is the gambit rarely works.

The key to the gambit is timing. Do it too soon, and you really haven't gained anything at all except suffering lower frame rates for six months. Wait too long, and it will make more sense to buy the next-generation card instead. An example of this is the GeForce 560 Ti dilemma. Originally $270, GeForce 560 Ti cards are now as low as $180. For a cheapskate, that's cheaper than having to shell out the $400 for a GeForce GTX 670, and you will get a decent frame rate increase you can feel. Six months from now, however, the 670 will have dropped in price or a new card will replace it, making the Multi-Card Gambit a foolish move.

THE RELEVANT CONUNDRUM

Cheapskates know the best time to buy a 2012 car is after the 2013 models have been introduced. But does that same wait-and-see approach hold up for CPUs? We looked at several popular models of CPUs and found that while buying the last-generation model can yield some savings, the tight controls the chip makers exert over their inventories can make this strategy unreliable. For example, the Core i7-2600K debut price in 2011 was $330. Today? It's $290. Its replacement, the Core i7-3770 is $330. The even more popular Core i5-2500K came out at $225 in early 2011. Today it costs $220, and its replacement, the Core i5-3570K, is $229. Intel's former top chip, the six-core Core i7-990X, made its debut at $999 last year. Today? It sells for $999. Its replacement, the Core i7-3960X, fetches $999. Even Intel's ancient Core i7-870 hasn't gotten cheaper over time after you factor in Intel's price cuts to it two years ago. We simply can't recommend paying $330 for a Core i7-870 today. Even eBay prices put the chip at $250 or more—and it's two generations old at this point.

But what about in AMD land, where the controls aren't as iron-fisted? There the prices are what you would probably expect when buying older hardware. Since its introduction, the AMD Phenom II X4 965 has made a stair-step drop from its initial price of $245 to $104 today. Even AMD's FX-8150 has steadily dropped from its $280 introduction to $199 today.

THE REAL HARDWARE HOARDERS OF ORANGE COUNTY

Cheapskates, invariably, want to "stock up" on a good deal when they see one. Frankly, we think that's a poor strategy to follow if not done wisely. Yes, such a move might look prescient in light of the Thailand floods of 2011 that caused hard drive prices to triple and quadruple overnight, but stocking up for future builds is often fraught with risks.

Take RAM, for example, which climbed in price late last year and seemed bound to climb higher following the bankruptcy of DRAM maker Elpida. The reality is, RAM prices are insanely low today. You can get four 8GB DIMMs of DDR3/1600 for $200. If you had stocked up on RAM last summer because prices were "headed back up," you would have paid $150 for four 4GB DIMMs of DDR3/1600. If you stocked up on DDR3 DIMMs now for a build next year, they would introduce DDR4 just to spite you.

It's far safer to bet on one constant in technology: It always gets cheaper, and it always gets better. So unless you're sure it's a killer deal you're getting, it's generally safer to wait until you need to buy it.

FOUR CLEVER USES FOR OLD HARDWARE

A true cheapskate never upgrades until his or her hardware is not only inoperable but irreparable. Take Gordon's trusty ThinkPad. It's so old it was made by IBM but has soldiered on with a new hard drive, RAM, and even CPU, and he still uses it every day.

Even the most reluctant upgrader, though, will occasionally find him- or herself with old hardware that still works to some degree—an ancient laptop, an old desktop, an aged MP3 player. If it ain't dead, put some new life into it. Here are five ways to stretch the value and the life span of your hardware.

MAKE IT A MEDIA CENTER

If your old desktop or laptop has at least a dual-core CPU and a couple gigs of RAM (so it can stream HD video), turn it into a media center! If you already have Windows installed, so much the better! You can use web-based video (like Netflix, Hulu, and HBO Go), plus if you install XBMC you can play all sorts of local video and audio files from the PC or the network. Use a remote-desktop program on your phone or tablet to control it, and you won't even need a keyboard and mouse!

TURN IT INTO A NAS

If you just want plenty of network-attached storage for backup and media streaming, turn your old PC into a NAS by using FreeNAS (www.freenas.org). It's easy to install and configure, and the latest beta of Version 8 contains support for plugins that will let you stream audio and video to the rest of your network via DLNA, UPnP, and iTunes.

TURN AN OLD SMARTPHONE INTO A MEDIA PLAYER

Have an old smartphone you're not using? Put it in airplane or Wi-Fi mode and use it as an app-enhanced media player! Plug it into your TV or stereo to access streaming music from the cloud, use it to read e-books and watch movies, and more! Fill it with games and give it to your kids! Many smartphone OSes include parental controls so you can disable Wi-Fi.

RECYCLE IT

If you have old electronics that still work but you don't need and don't want to repurpose, consider donating them to a charity or nonprofit. There's probably one in your area that could use the extra gear. If your stuff is nonfunctional or really obsolete (think Pentium 4 or earlier), take it to an e-cycler who can dispose of it safely. It's what Captain Planet would have wanted.

BUILD A $600 PC

AN ALL-AROUND-CAPABLE, KICK-ASS RIG DOESN'T NEED TO COST A FORTUNE

There's no such thing as a no-compromises $600 build. There just isn't. But by balancing things where you can and making judicious cuts where necessary, you can at least build a modern gaming PC—with an upgrade path to the future. That means a full quad-core CPU, DirectX 11 GPU, and a fast hard drive. To paraphrase Han Solo, she may not look like much, but she's got it where it counts.

AMD
Phenom II
X4

CPU
AMD PHENOM II X4 965 BLACK EDITION

The Phenom II ain't the newest or fastest CPU on the block, not by a long shot. But it's a cheap, overclockable quad-core with plenty of bang for the buck. We got it for $100. www.amd.com

MOTHERBOARD
GIGABYTE GA-970A-UD3 ATX

It's not the fanciest or the flashiest, but it has USB 3.0 and 6Gb/s SATA and supports not just our Phenom II but also FX CPUs, if we want to upgrade later. It only has one x16 PCIe 2.0 slot, but that's what you get for $99. www.gigabyte.us

MEMORY
PATRIOT GAMER 2 SERIES 4 (2X 2GB) DDR3/1600

4GB is really the minimum, and we wish we could have gone for more, but every penny counts. Two 2GB sticks allow us to run in dual-channel mode at DDR3/1600 for just $32. www.patriotmemory.com

CASE AND POWER SUPPLY
ROSEWILL R218 W/450W PSU

OK, this is definitely a compromise. If we had our druthers, we'd go for a separate case and PSU, but we don't have our druthers. We have about $43. At least it comes with a warranty. We've used this case/PSU combo before, and nothing bad happened. www.rosewill.com

GRAPHICS
GIGABYTE RADEON HD 6850 1GB

It's slightly more expensive and draws more power than the modern-gen Radeon HD 7770, but it's also faster. Last generation's where the deals are. It's still DX11, and it's only $138. www.gigabyte.us

HARD DRIVE
SEAGATE BARRACUDA 1TB 7,200RPM

In a $600 budget build, you only get one hard drive and no SSD. It needs to be fast and capacious. This Barracuda is both, and it's only $75. www.seagate.com

OPTICAL DRIVE
LITE-ON IHAS124-04 DVD/CD WRITER

It's a DVD burner. It's $18. If you're on a budget, you can't go without an optical drive. www.lite-on.com

OS
MICROSOFT WINDOWS 7 HOME PREMIUM (64-BIT)

We could have cheaped out and recommended Windows 8 Consumer Preview for free, but that's a bit like cheating. $100, www.microsoft.com

TOTAL PRICE: $605

At this price point, we're going without many of the things we love best about custom PCs—no SSD, no aftermarket cooler, no cool case—but what we have is a desktop PC that will handle modern games and programs, will accept upgrades with ease, and doesn't break the bank. It's far slower than our zero-point, but that machine is built on a six-core Sandy Bridge-E CPU with a $1,000 GPU and is designed to compete with $3,000 rigs. Even with a Radeon HD 6850, our Cheapskate PC puts out nearly playable frame rates in Arkham City at 2560x1600 with all settings maxed. It's more than enough to run on high settings on a smaller screen. As for the CPU-bound encoding tests, the Cheapskate's Phenom II doesn't keep up, but for a gaming machine it's fine.

There's plenty of room to upgrade, too. The AM3+ motherboard will take a Bulldozer CPU like the FX-8150 and the upcoming "Vishera" FX chips, when they appear. You can easily put another 8GB (or more) of RAM alongside the existing 4GB. The motherboard's second physical x16 PCIe slot runs at 4x, so CrossFire builds will be compromised, but you could update to a newer single-GPU setup down the line. An SSD would speed up boot and load times, and a more powerful PSU will allow more drives and a more power-hungry CPU and GPU. ⏻

BENCHMARKS

	ZERO-POINT	
Premiere Pro CS6 (sec)	2,000	10,433 (-81%)
Stitch.Efx 2.0 (sec)	831	1,566 (-47%)
ProShow Producer 5.0 (sec)	1,446	2,658 (-46%)
x264 HD 5.0 (fps)	21.1	9.1 (-57%)
Batman: Arkham City (fps)	76	27 (-64%)
3DMark 11	5,847	1,164 (-80%)

0% 10% 20% 30% 40% 50% 60% 70% 80% 90% 100%

Our current desktop test bed consists of a hexa-core 3.2GHz Core i7-3930K 3.8GHz, 8GB of Corsair DDR3/1600, on an Asus Sabertooth X79 motherboard. We are running a GeForce GTX 690, an OCZ Vertex 3 SSD, and 64-bit Windows 7 Professional.

BY THE MAXIMUM PC STAFF AND MARCO CHIAPPETTA

FIX IT!

WINDOWS WON'T BOOT. YOUR HARD DRIVE WON'T SPIN AND YOUR INTERNET IS SLOW. NO THIS AIN'T NO COUNTRY SONG, IT'S WHAT HAPPENS WHEN THINGS ON YOUR PC BREAK. WE TACKLE ***THE FIVE MOST PRESSING PROBLEMS IN EACH MAJOR COMPONENT CATEGORY!***

It's happened to us all. You get home from a long day at work and you want to blow off some steam with an hour of gaming or maybe browsing the web, but when you tap your mouse button or punch the power switch, the unthinkable happens. You're SOL.

Whether the system is red-lining, the OS is BSODing, or your Internet is crawling on all fours, this frustration is familiar to any person who drives a PC. You're faced with a problem that stops you dead in your tracks. If you're a salty self-tech, you run through your proverbial checklist of areas to look at. But not everyone is so experienced, and even old hands have holes in their troubleshooting repertoire. So, in the interest of providing the most useful advice to the greatest number of people, we've compiled a list of the top five problems that could impact each of your computer's major hardware or software subsystems and our best advice on how to fix them.

WorldMags

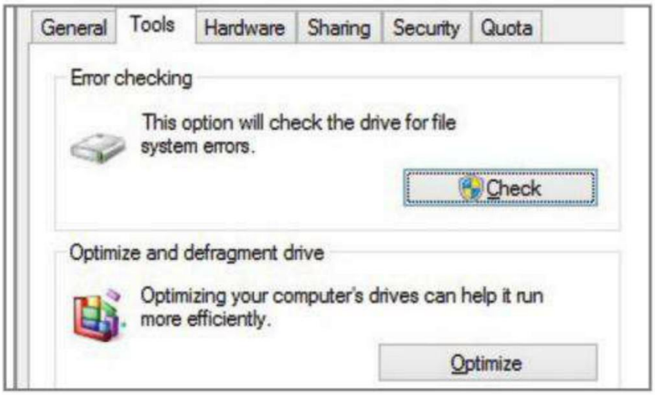
Storage

What to do when your hard disk is dying and your SSD is sputtering

PROBLEM: HARD DRIVE DISAPPEARS

SOLUTION: If it's a drive that was previously visible, the first step is to see if the drive shows up in the BIOS (check under Boot). If not, swap out the SATA and/or power cables. If the drive shows up, run CHKDSK on it by right-clicking the drive in My Computer, choosing Properties, then the Tools tab, and then "Check now" and "Automatically fix file systems errors." If the drive continues to give a ton of errors, and is behaving erratically but is visible in Windows, copy all data off it immediately if you can, or run Data Recovery on it STAT. If the drive is *not* visible in Windows, your options are limited to the Freezer Trick (an hour or so of extreme cold sometimes sets things straight) or expensive forensic-style data recovery.

If this is a brand-new drive that's not showing up, you need to initialize it first. Right-click My Computer and select Manage, then Disk Management and follow the prompts.



Error checking

This option will check the drive for file system errors.

Optimize and defragment drive

Optimizing your computer's drives can help it run more efficiently.

PROBLEM: OPTICAL DRIVE DISAPPEARS

SOLUTION: This classic conundrum involves either a missing drive or one that stops functioning suddenly. Put on your big-boy pants and type **regedit** in the Start menu search box, then navigate to HKEY_LOCAL_MACHINE\SYSTEM\CurrentControlSet\Control\Class\{4D36E965-E325-11CE-BFC1-08002BE10318}. If you see an entry named UpperFilters, delete it. If you see an entry named LowerFilters, delete it. Once you've done this, exit Regedit and reboot your system. In most scenarios, your optical drive will reappear and/or magically begin working again. Note that you may have to reinstall software that accesses the optical drive (e.g., burning software) to get back to 100 percent functionality.

PROBLEM: DRIVE NOT REPORTING FULL CAPACITY

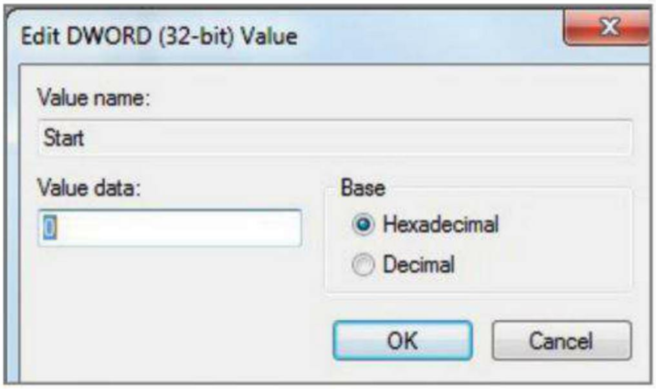
SOLUTION: This is usually an issue with 3TB or 4TB drives, as 2TB drives should have zero issues in Win7 (WinXP users might have to download a utility from the drive's manufacturer to allow for a drive with 4K sectors). Out of the box these 3/4TB drives are typically MBR disks, which limits a partition to 2TB (actually, 1.8TB or so) relegating the rest to a separate partition. If you want the full capacity in one partition, you need to convert the disk to GPT. To do this, type **cmd** at the Start search box; at the prompt type **diskpart**, then **list disk**, then **select disk X** (substituting X for your drive number), then **convert GPT**. Now go to Disk Management and create your massive single partition.

PROBLEM: SSD PERFORMANCE IS SLOW

SOLUTION: If you're using a hard drive and it feels slow, don't worry; that's how they are for the most part. If you're using an SSD and its slow, there is a problem. If you're not sure if it's slower than spec, download CrystalDiskMark and see what kind of sequential-read/write speeds you are getting. Second, make sure the drive is connected to the native SATA 6Gb/s ports on the motherboard. You can't rely on color, only your mobo manual, to tell. Third, go into the BIOS and make sure the SATA port for that drive is set to AHCI mode instead of IDE mode, as that will usually give you better performance.

PROBLEM: AHCI CAUSES BSOD

SOLUTION: Sometimes, people install Windows 7 without AHCI enabled, only to find out that enabling it after the install causes a BSOD. To fix this, you have to edit the registry. Press Windows + R key, type **regedit**, then navigate to HKEY_LOCAL_MACHINE\SYSTEM\CurrentControlSet\services\msahci. Then right-click the word Start on the right-side and click Modify. Change the value in the window to "0" and click OK. Exit Regedit, reboot the system, and change your SATA controller to AHCI; you will boot right into Windows.



Edit DWORD (32-bit) Value

Value name: Start

Value data: 0

Base

● Hexadecimal

○ Decimal

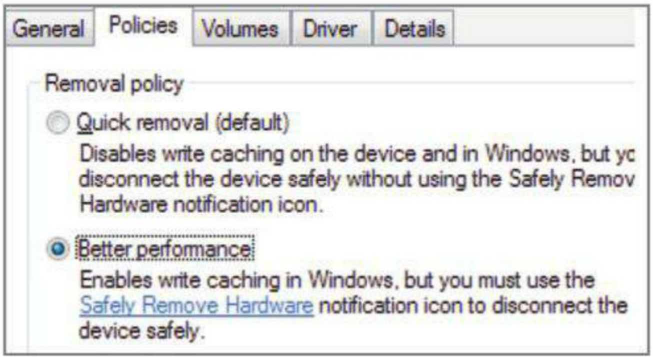
USB What to do when it won't plug nor play

PROBLEM: SOME USB PORTS DON'T WORK

SOLUTION: Nonfunctional USB ports could be caused by a few things. If the ports are front-mounted, make sure the internal cables are connected properly and that the requisite USB header is enabled in your system BIOS. If the ports are soldered on the motherboard (and enabled), open up Device Manager and see if any USB root controller or hubs are reporting a problem. If so, a driver update/reinstallation may resolve the issue. It's also possible that the physical connectors have been damaged (or a fuse has blown), in which case you'll have to re-solder some new ones onto the board. If the USB ports are associated with a third-party controller, be sure its drivers are installed, because Windows may not recognize the controller automatically.

PROBLEM: SLOW FILE TRANSFER OVER USB

SOLUTION: Windows Vista and 7 have some known USB performance issues, so the first thing to do is run Windows Update and make sure your OS is fully patched. We'd also advise installing the latest drivers for your motherboard's chipset and any discrete USB controllers. You could also try setting the USB drive to performance mode. Open Device Manager, right-click the USB drive, and choose Properties from the menu. In the resulting window, click the Policies tab and tick the option labeled "Better performance." Please note, this feature will enable write caching, so you'll have to use the Safely Remove Hardware option when disconnecting the drive to prevent any data loss.



Removal policy

○ Quick removal (default)

Disables write caching on the device and in Windows, but yc disconnect the device safely without using the Safely Remov Hardware notification icon.

● Better performance

Enables write caching in Windows, but you must use the Safely Remove Hardware notification icon to disconnect the device safely.

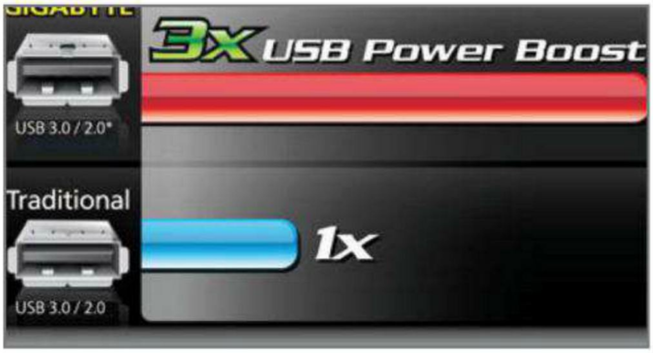
PROBLEM: USB HUB DOESN'T WORK

SOLUTION: This problem is almost always caused by insufficient power being supplied to the hub. If the hub came with an AC adapter, make sure it's plugged in and working properly. And if you've got the hub plugged into a front-mounted USB port, try connecting it to a rear port that is soldered onto your mobo. Rear-mounted ports can usually provide more power (or more stable power), which can resolve some issues with finicky hubs.

PROBLEM: CHARGING PHONE OVER PC'S USB PORT TAKES FOREVER

SOLUTION: Standard USB 2.0 ports connected on a root hub have to share 500mA of current (USB 3.0 powers up to 900mA). If you've got a bunch of USB devices connected and the port your phone is plugged into is competing for limited power, it will take much longer than normal to charge. Try plugging the phone into a different port (preferably USB 3.0, if possible) or disconnecting other USB devices while charging.

It's worth noting that some motherboard manufacturers—such as Gigabyte—have begun incorporating high-powered USB ports that can deliver up to 2.7A of current onto their boards. If you want to rapidly charge devices while they're connected to your system, it may be worth checking out one of these boards.



PROBLEM: USB DEVICE IS NOT RECOGNIZED

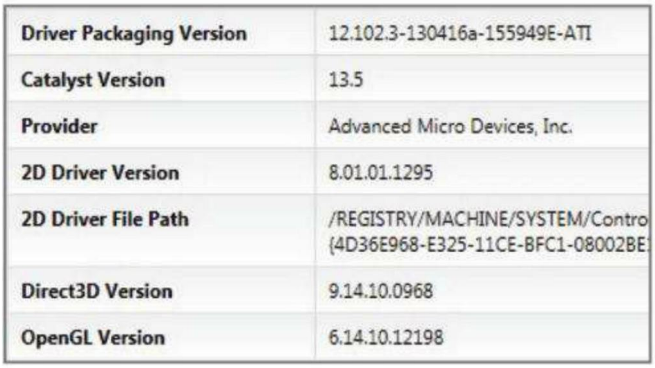
SOLUTION: USB devices are usually as plug-and-play as you can get, but if a particular device isn't recognized properly, it may be incompatible with your USB controller or require drivers to be manually installed. Compatibility is very good with USB controllers native to modern chipsets, but we've seen some incompatibilities with some discrete USB 3.0 controllers that are yet to be resolved. Should you need to install drivers for the device, plug it into a USB port, then go to Device Manager, right-click the device, and choose Update Drive Software from the menu. Then, you can search the web for drivers automatically or point the wizard to any drivers downloaded from the device manufacturer's website.

Video Cards

Gee, pee-yew!

PROBLEM: GPU IS SLOW

SOLUTION: If your GPU is lagging, the first stop on the road to redemption is a driver update. Both Nvidia and AMD are engaged in a drivers arms race, with each company updating its drivers with an OCD-like frequency that's impressive. And always check to see if there's a new driver before you launch a brand-new game. You can find your driver version easily in both Catalyst Control Center under Information/Software, and in the Nvidia Control Panel. Overheating can also cause the GPU to throttle its clock speeds, so monitor your temps using the software provided by your GPU manufacturer.



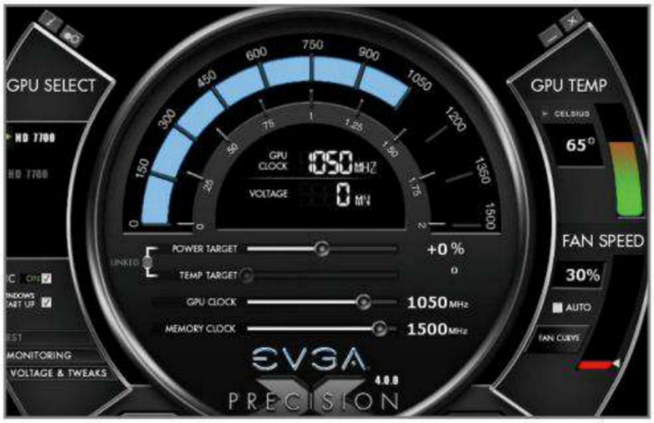
Driver Packaging Version	12.102.3-130416a-155949E-ATI
Catalyst Version	13.5
Provider	Advanced Micro Devices, Inc.
2D Driver Version	8.01.01.1295
2D Driver File Path	/REGISTRY/MACHINE/SYSTEM/Contro {4D36E968-E325-11CE-BFC1-08002BE
Direct3D Version	9.14.10.0968
OpenGL Version	6.14.10.12198

PROBLEM: MULTICARD SETUP NOT WORKING

SOLUTION: Dual-card setups can be problematic for a number of reasons, and getting them recognized by Windows is the first challenge. If CrossFireX/SLI isn't an option you see in the software, ignore your motherboard's color coding and move the second card to a different PCIe slot. Games are a different story, as the drivers have to include a profile for a certain game, benchmark, or application to allow both cards to function, so there is usually a bit of a wait after a game comes out for a compatible driver (EVGA uniquely offers temporary profiles for new games). Assuming dual-card mode is enabled in the drivers, and the game has been out awhile, your SLI/CrossFireX bridge could be faulty, but that is rare. You can try forcing dual-card mode via the Catalyst Control Center or Nvidia Control Panel, but success is hit-or-miss when doing this.

PROBLEM: SCREEN CORRUPTION AND ARTIFACTS

SOLUTION: Graphical corruption is usually due to one of two things: a video card that is either overheating or dying. First, check your temps using software like MSI Afterburner, EVGA Precision X, Asus GPU Tweak, GPU-Z, etc. Anything below 80 C is fine but a well-cooled card typically doesn't exceed 70 C. Second, take your GPU out of the case and give it a good cleaning with compressed air, and after you reinstall it, put some cool air on it by removing the case door for a bit, or manually turn up the fans to 100 percent using the above-mentioned software. To see if your card is dying, try running it in a friend's system to test; conversely, use his or her card in your system. Also, if you are overclocking, immediately go back to stock speeds.



GPU CLOCK 1050 MHZ
VOLTAGE 0 MV
GPU TEMP 65°
FAN SPEED 30%
POWER TARGET +0 %
TEMP TARGET 0
GPU CLOCK 1050 MHz
MEMORY CLOCK 1500 MHz

PROBLEM: DISPLAY AND RESOLUTION ISSUES

SOLUTION: While not as common, you should never overlook a cable/connection issue as the cause of your problem. If you are running 2560x1600 resolution, you probably need a dual-link DVI cable (and therefore a dual-link DVI port on the video card, as well—some DVI ports are single-link, so check). DisplayPort also runs at 2560x1600, but VGA and single-link DVI do not. Also double-check the input source for your LCD, as that's a mistake that even non-rookies make. And double-check the cable you're using—swap it out if possible.

PROBLEM: SECOND DISPLAY NOT RECOGNIZED

SOLUTION: First, make sure you are running the latest drivers. Many systems that are running the default Windows drivers have issues with this. Second, make sure you have gone into the control panel of the drivers to enable the second display. Third, some DVI ports do not work if you are using a VGA-DVI adapter, so if there are two ports on your card, try them both. If you have everything set normally in the drivers, make sure your Windows settings are configured properly, and that you have multiple displays enabled.

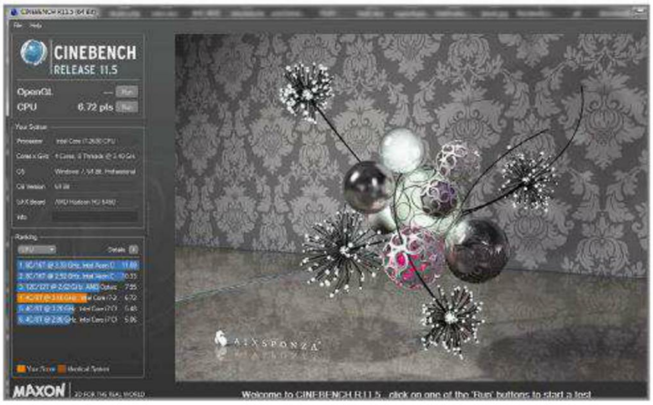
CPU *It's* usually not the culprit

PROBLEM: CPU IS OVERHEATING

SOLUTION: Don't assume that high temps automatically warrant a new heatsink. The cooler is likely dust-clogged (try cleaning it), or the fan is dying (requiring a replacement). Or the heatsink has been poorly installed—remove it and remount it with new thermal paste. (Incidentally, degraded thermal paste alone can be the culprit). Other possible causes include the case fans—clean and check them. Or a newer, hotter GPU could have swamped your case's ability to stay cool. A BIOS update could also change the fan profiles from what you had set. Also keep this in mind: If your CPU is seemingly running "hot" but the machine isn't blue-screening or throttling clock speed, you probably don't have to sweat it.

PROBLEM: CPU IS SLOW

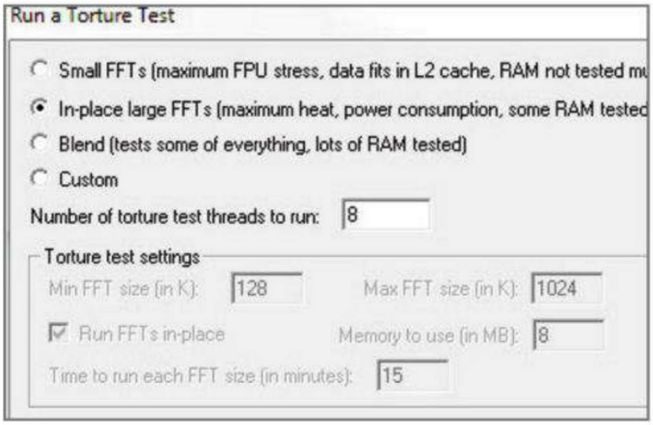
SOLUTION: CPU performance issues typically come from misconfiguration in the BIOS or overheating. First, verify your chip's clock speed by running CPU-Z (www.cpuid.com) while running a CPU load in Cinebench 11.5 (www.maxon.net). If the clocks are correct (remember, chips don't Turbo under heavy loads on all cores), compare your Cinebench 11.5 scores with others on the Internet. The scores should be within a few percentage points of others. If the scores are close, the CPU is not "slow;" it's something else in your system. If the scores don't match, you may have a thermal issue. Check that your heatsink hasn't come loose, reapply thermal paste, and clean the heatsink and fans. A BIOS update could also be needed, as well.



Welcome to CINEBENCH R11.5 - click on one of the 'Run' buttons to start a test

PROBLEM: CPU IS UNSTABLE

SOLUTION: CPUs rarely "go bad." They typically work or don't work. Usually, it's everything around them that breaks. If you're overclocking, stop. Try to isolate CPU problems by running a CPU-intensive app such as Prime95. If it blue-screens, check thermal issues first (see "CPU Is Overheating"). Also check your RAM with Memtest86+ (www.memtest.org). Check your power supply connectors to the mobo and GPU. If the PSU is overheating and failing, it could cause crashes. Failing PSUs cause power sags, which can look like a bad CPU, too. If you have a known good PSU you can swap in, do so. Oddly enough, a failing GPU can resemble a CPU failure, so if you have a spare GPU or an integrated option, try switching to it and testing again.



Run a Torture Test

○ Small FFTs (maximum FPU stress, data fits in L2 cache, RAM not tested mu

● In-place large FFTs (maximum heat, power consumption, some RAM tested

○ Blend (tests some of everything, lots of RAM tested)

○ Custom

Number of torture test threads to run: 8

Torture test settings

Min FFT size (in K): 128 Max FFT size (in K): 1024

☑ Run FFTs in-place Memory to use (in MB): 8

Time to run each FFT size (in minutes): 15

PROBLEM: CPU IS ALWAYS UNDER A HEAVY LOAD

SOLUTION: Heavy CPU usage can be a sign of malware, so make sure your AV is updated and run a full system scan. Also consider running a secondary scan using Malwarebytes Free (www.malwarebytes.org) and any of the free web-based scanners such as those from Trend Micro, Bit Defender, or ESET. Also check to see that your own AV app isn't thrashing the system by doing a scan—check the running processes in Task Manager (Ctrl + Alt + Del, Start Task Manager, select Processes.) Click the CPU column to sort by usage and begin searching the Internet for each suspicious process name.

PROBLEM: CPU ONLY WORKS IN SINGLE-CHANNEL MODE

SOLUTION: First, make sure the RAM is OK by running Memtest86+ (www.memtest.org). If the RAM clears, check the slots for debris and swap out the DIMMs for known good RAM. If crashing persists when put into dual-channel mode, you likely bent a pin installing your CPU. We've seen this on LGA1366 and LGA1155 platforms several times. It can be fixed by taking a sharp knife and carefully straightening the pin in the socket (or on the CPU in AMD chips).

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Network Why can't it just work?

PROBLEM: INTERNET CONNECTION DROPS

SOLUTION: The most likely culprit is your ISP, so prepare to wait on hold. Before you do, though, try some basic troubleshooting.

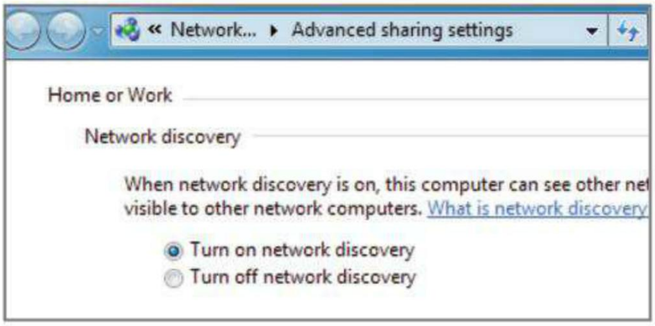
If your system(s) connects through a router, connect the system directly to your modem to see if the router has a problem, and also cycle the power on your broadband modem. But don't just quickly hit its power switch or reset button. Unplug it from power for a few seconds. Plug it back in and wait for the modem to resync with your ISP's network before testing the connection again. If you find yourself resetting your modem monthly or even weekly to resolve Internet connectivity issues, a call to your ISP is in order. There may be an issue that only a modem replacement or a service tech can fix.

PROBLEM: FILE DOWNLOADS TAKE FOREVER, PING TIMES SUCK

SOLUTION: Contrary to popular belief, there aren't any tweaks that will significantly speed up or improve Internet connection speeds. If your connection is usually fast, but slows during peak hours or only when connecting to certain sites, there may not be much you can do. You should certainly run a broadband test to see where your speeds actually are. ISPs usually have a guaranteed speed band that, if you're under, they will either fix or charge you less for. Also, power cycle your modem and router. Check your router's log to see if you have an unauthorized guest sapping speed. Streaming Internet cameras, or streaming Netflix to multiple devices will also sap performance.

PROBLEM: CAN'T ACCESS NEW SERVER/NAS/PC FROM OTHER SYSTEMS

SOLUTION: There are a number of things that could cause a new system/NAS to be inaccessible from other machines on a network. First, make sure the new system is definitely connected to the LAN properly and that its network controller is active. And also check that the system's configured with the correct IP address. If the server or NAS is on a different subnet, for example, it may appear to be connected to a network, but it won't be visible to your other systems. With a standalone NAS device, you'll have to log into its configuration menu, navigate to the LAN settings, and then enter the proper IP address (or set it to DHCP). To change an IP address on Windows 7 systems, you'll want to go to Network and Sharing Center, click the Local Area Connection, then click the Properties button, highlight Internet Protocol Version 4 (TCP/IPv4), and then click Properties again. You can change the system's IP address on the General tab.



Home or Work

Network discovery

When network discovery is on, this computer can see other ne
visible to other network computers. What is network discovery

● Turn on network discovery
○ Turn off network discovery

It's also possible that your client PC has network discovery disabled or an overzealous firewall that won't let the system see other devices, so check that, too.

PROBLEM: SSID APPEARS BUT CAN'T CONNECT USING WI-FI

SOLUTION: Wi-Fi connectivity problems are almost always caused by interference or firmware and/or driver incompatibilities. The first thing to try is to simply reset your wireless router in case something's gone wonky that a reboot might fix. Pull your router's power cord, wait a few seconds, and then plug it back in. Once the router has fully booted, try to connect again.

If the issue persists, the wireless channel being used by your router may be congested. Download a utility like Insider (www.metageek.net) to your laptop, or Wi-Fi Analyzer to your smartphone, and scan the wireless networks in the area. If your router is using the same channel as many others within range, log into your router's configuration menu, navigate to the wireless network section, and change the channel to the one that's least used in the area.

If that doesn't help, try updating the router's firmware. Hit your router manufacturer's website and check for a firmware update. If one is available, download it, and then log into the router's configuration menu and apply the update (this process will vary from router to router—consult your manual). Once the firmware update is installed, configure the wireless network settings and try connecting again. Updating the drivers for your wireless network controller is worth a shot, too.

PROBLEM: INTERNET CONNECTION IS UNRELIABLE

SOLUTION: Unreliable or intermittent Internet connections are usually the result of a hardware or signal problem at some point between your PC and the web. Some of these problems you can fix, others may require a service call from your ISP.

The first thing to try is resetting your modem and router and swapping out the network cables between them. Kill the power to your modem and router, wait a few moments, and then power them back up. Also, be sure to use known good cables to connect the devices together. We can't count how many times a faulty cable has caused funky issues on a network. If the problem persists, give your ISP a call and have it run a diagnostic to check the signal strength and quality on your line. Should your ISP find a problem, odds are it can be fixed by a service technician.

Sleep

Even PCs can get insomnia

PROBLEM: WHEN PC GOES TO SLEEP, I CAN'T WAKE IT BACK UP

SOLUTION: Systems that don't wake up after going to sleep usually have a device connected or an internal component that misbehaves when the machine enters the sleep state. If you're lucky, the device is throwing an error before the system hangs and you can ascertain the culprit by checking out Event Viewer (click your Start button, type **event viewer** in the search field, and hit Enter. Then check the system log for critical errors). If your system isn't providing any clues, though, run Windows Update to ensure the OS is fully patched and also try updating your device drivers, especially for components like graphics cards, chipsets, and storage controllers.

It's also possible that a device connected via USB is the root cause of the problem, so try disconnecting any nonessential devices until you figure out which one's at fault.

PROBLEM: WAKING PC CAUSES CRASH

SOLUTION: A vital component or driver that doesn't reinitialize properly when the system is coming out of the sleep state is most likely the cause of the crash. More often than not, driver and/or firmware updates can resolve issues like this one. A flaky piece of hardware, like a bad stick of RAM, can also be the root cause, but software issues are much more likely, especially if the system is stable and behaves normally otherwise. Add-in storage controllers and older graphics cards are commonly the cause of sleep-related instability, so make sure you're using the latest drivers and firmware for both. Installing the latest BIOS on your motherboard and using the latest drivers for your chipset are also recommended.

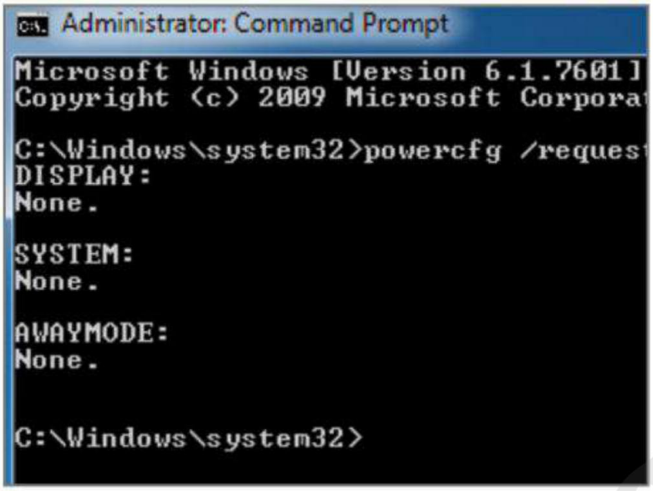
PROBLEM: PC CRASHES WHEN IT GOES TO SLEEP

SOLUTION: The most likely solutions to this problem are virtually identical to the previous question, so follow our recommendations above. Also keep in mind that if the crash results in a memory dump and an event being written in the system log, checking out the details in Event Viewer can help quickly sniff out the offender. Googling the actual error codes or using a utility like BlueScreenView can also come in handy to help pinpoint the cause.

PROBLEM: SYSTEM KEEPS WAKING FROM SLEEP

SOLUTION: A few things can cause a system to constantly wake from sleep. One of the more common problems is a pesky malware infestation that triggers some sort of scheduled task, so run a scan on your system to be sure it's not infected.

A component in the system can also be the culprit. To find out exactly what caused your system to wake up, open a command prompt with elevated privileges (type **cmd** in the Start search, right-click and Run as Administrator); at the prompt type: **powercfg /lastwake** and the utility will list the device or service that last woke the PC. If it turns out it was a nonessential service, you can simply disable it. If a system component was the cause, open Device Manager, find the component, right-click it, and choose Properties from the menu. In the window that pops up, click the Power Management tab and uncheck the field labeled "Allow this device to wake the computer."



```
Microsoft Windows [Version 6.1.7601]
Copyright (c) 2009 Microsoft Corporat

C:\Windows\system32>powercfg /reques
DISPLAY:
None.

SYSTEM:
None.

AWAYMODE:
None.


C:\Windows\system32>
```

PROBLEM: PC WON'T GO TO SLEEP

SOLUTION: If your PC won't go to sleep, check that you've got it configured to go to sleep in the first place. Click your Start button, type **power options** in the search field, and hit Enter. Then click the "Change plan settings" link for the plan you have selected and make sure there is a value in the "Put the computer to sleep" field.

If you're certain the system is configured properly for sleep, but it still won't power down, open a command prompt with elevated privileges and at the prompt type **powercfg /requests** and hit Enter to see a list of items that are preventing the system from going to sleep. Once you've found the culprit, disable it (if it's nonessential) or change its Power Management settings (see above) and your PC should go to sleep.

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Windows

What's made of 50 million lines of code and rarely breaks? Nothing

PROBLEM: WINDOWS IS FREEZING

SOLUTION: The biggest culprits here are usually malware (malicious software, whose favorite installation method is through browser exploits) or high temperatures in your case. With malware, there are no real standards for quality, so badly written ones can cause all kinds of performance issues. The stuff is also designed to be hard to find and hard to remove, so your antimalware software (Norton, McAfee, or Malwarebytes) might not remove it. In which case, you may need to reinstall Windows.

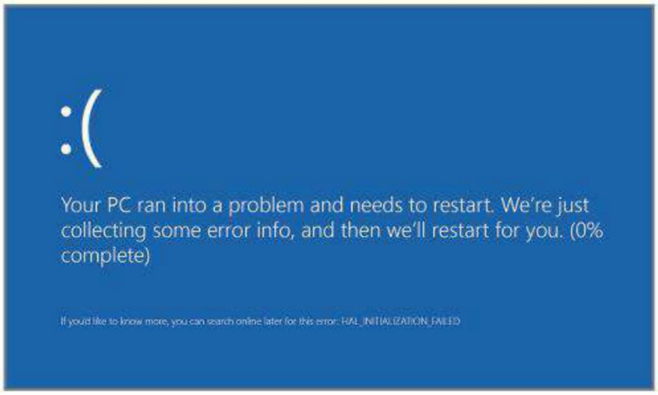
But before you nuke it from orbit, how dusty is your case? The stuff insulates whatever it's collected on and will clog fans over time. But a can of compressed air held upright and triggered in short bursts should take care of most of it.

Case vibration over time can also loosen cables and cause random loss of signal, so make sure those are all squared away (and not chewed up by gremlins).

Lastly, if you're overclocking your CPU or GPU, you may just need to tone that down a bit.

PROBLEM: BLUE SCREEN ERROR

SOLUTION: The usual villains are beta GPU drivers and overclocked CPUs (but feel free to Google specific error messages). GPU drivers see the most frequent changes in enthusiast PCs, and beta versions are sometimes shaky. You can uninstall these drivers in the Add or Remove Programs section of your Control Panel (Programs and Features in Windows 8), where the files are labeled according to your brand (usually Nvidia or AMD, sometimes Intel). Then reboot and install an older version of the driver obtained from the manufacturer's website, preferably the drivers labeled "WHQL" (for Windows Hardware Quality Labs), Microsoft's seal of approval. Didn't write down the BSOD info? Check out BlueScreenView (www.nirsoft.net).



:(

Your PC ran into a problem and needs to restart. We're just collecting some error info, and then we'll restart for you. (0% complete)

If you'd like to know more, you can search online later for this error: HAL_INITIALIZATION_FAILED

PROBLEM: WINDOWS SLOWS DOWN

SOLUTION: The most common source of this problem is a program eating up your CPU power or RAM. Sometimes it's a memory leak, which means that a program isn't releasing RAM that it's no longer using, which can snowball over time to occupy all available memory. Restarting the program should fix the leak temporarily, but the long-term solution usually requires the program's creator to produce a new version. Other times, it can be a scheduled virus scan running in the background, or even a virus or other malware.

WHAT TO DO WHEN WINDOWS WON'T START

LET'S SAY YOU can get your computer to perform its POST (power-on self-test, which ends with a single, short beep from your motherboard if you have a speaker installed on it), but Windows itself won't load. Before you start sweating through Google searches, sometimes the problem is temporary and random; simply restarting your PC can make the problem go away.

If your PC tells you that a file called NTLDR.exe is missing, the problem may be more serious. Sometimes you can just create a new version of this file. For Windows 7, reboot and hit F8 just before Windows would start loading. This loads a troubleshooting menu, from which you select Repair Your Computer. This is mostly an automated process; you follow a few onscreen instructions and let Microsoft take the wheel. For Windows 8, you boot from its installation disc to access repair options, or you may have a Recovery Drive on a USB stick. To make your computer boot to those devices instead of Windows, consult your motherboard manual for the keyboard shortcut that can open your boot menu during the POST.

To check background programs, press Ctrl + Shift + Esc, which opens the Task Manager. You can click the labels at the top of each column to sort alphabetically, or by CPU or RAM usage. Save your documents or whatever else you were working on at the time. Then, if a program is eating up your resources and you don't recognize it, Google its name to determine its danger level. If it's not supposed to be there, you may need to manually run a virus scan to remove it. Or you may just be able to right-click the program in the Task Manager list and select End Process. In some cases, simply rebooting can make sluggishness issues disappear.

PROBLEM: WINDOWS UPDATE HANGS

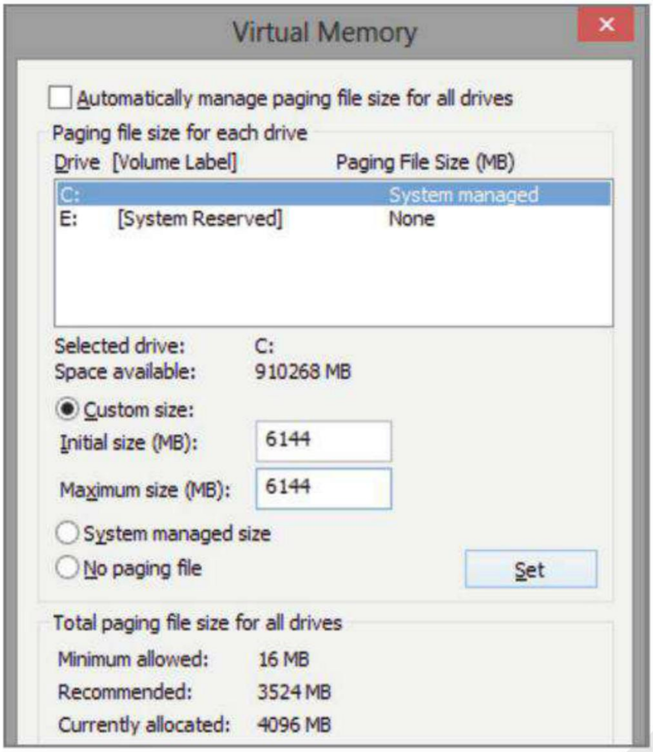
SOLUTION: First, is the time and date right on your PC? Microsoft has a "Fix It" file available on its support page that talks about this issue, Article ID 2700567. Just run that, and it may fix your issue. If not, you may have to use System Restore to reset Windows to before it hung on Windows Update. In Windows 8, you get there by restarting your PC, clicking the power icon on the login screen, holding down the Shift key, and selecting Restart. That will load a screen with some troubleshooting options. Select Troubleshoot, then Advanced Options. When you click System Restore, your PC will reboot in the Restore mode. Select your account, select Next on the next screen, choose your Windows drive, hit Next again, then wait for the restore process. You can hit Restart when that's done, then redo WIndows Update.

If your system isn't booting in Windows 7 and you need to restore, you need the installation disc and access to an admin account (home desktop users have this account type by default). Pop in the disc, reboot, and press any key when your PC prompts you to (shortly after the POST, but before your current Windows installation would start loading). Click through the CD's language, time, and input settings, select "repair your computer," and follow the onscreen instructions. The most recent Restore Point should work. After this process reboots your computer, try Windows Update again.

PROBLEM: LOW MEMORY

SOLUTION: If it's not a memory leak (see "Windows Slows Down) or other program hogging your RAM, you can try increasing your virtual memory, which is a cache that Windows stores on your hard drive. Right-click the Computer icon on your desktop and select Properties. (In Windows 8, switch to Desktop Mode to see the icon.) Click Advanced System Settings on the left. In the section labeled Performance, click the Settings button. Click the Advanced tab and click Change. Uncheck the box at the top and select Custom Size. A good rule of thumb is to set Initial Size and Maximum Size to 1.5 times your amount of RAM (listed on the Properties window you opened earlier). More than that can actually slow down your PC. Click Set and then click OK.

Editing high-def videos, high-res photos, or large audio files can eat up gigs of RAM, too. If that's something you do, adding more RAM is not a bad idea, assuming you have available slots on the motherboard and you can find sticks of the same type and speed.



Virtual Memory

☐ Automatically manage paging file size for all drives

Paging file size for each drive

Drive [Volume Label]	Paging File Size (MB)
C:	System managed
E: [System Reserved]	None

Selected drive: C:
Space available: 910268 MB

● Custom size:
Initial size (MB): 6144
Maximum size (MB): 6144
○ System managed size
○ No paging file

Total paging file size for all drives
Minimum allowed: 16 MB
Recommended: 3524 MB
Currently allocated: 4096 MB

Sometimes, you can still boot into Safe Mode to diagnose the problem. This is a stripped-down environment—only the minimum necessary services and drivers will load. For Windows 7, this is accessed via the F8 menu mentioned above. For Windows 8, you must also hold down the Shift key when pressing F8. It may take several tries to get your timing right, because your window is small. This will load Windows 8's recovery mode. Once there, click Troubleshoot to get a number of options, including loading a restore point, recovering from a backup drive image, accessing the command prompt to enter text commands, and altering Windows startup settings. It's not a bad idea to try the restore point or drive image options, if you created those recently. If not, then click the Startup Settings button, then click Safe Mode. Once this mode has loaded, you can try running a virus check or uninstalling recently installed programs or drivers.

It could also be a loose data cable on the storage device that contains your Windows installation, making it invisible to your PC. You'll want to shut down your rig, open the side panel, and do a spot check.

It's also possible that the drive Windows is installed on is dead. Storage devices usually do not give much warning of imminent failure. At most, you'll hear some crunchy sounds or clicking before they give up the ghost. If you install the drive in another computer and you still can't "see" it, it's probably a goner.

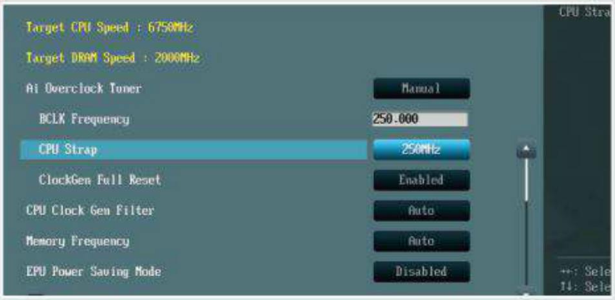
WorldMags

THE 10 COMMANDMENTS OF TROUBLESHOOTING

Important life lessons for dealing with a broken PC

1. PAUSE YOUR OVERCLOCK

Overclocking is indeed a wonderful way to get free performance, but when you are troubleshooting a mysterious issue, put a pause on your extracurricular clock-pushing.



Target CPU Speed : 6750MHz
Target DRAM Speed : 2000MHz
Ai Overclock Tuner: Manual
BCLK Frequency: 250.000
CPU Strap: 250MHz
ClockGen Full Reset: Enabled
CPU Clock Gen Filter: Auto
Memory Frequency: Auto
EPU Power Saving Mode: Disabled

2. DO NOT USE MICROSOFT AS A BOOGEY MAN

It's easy to point fingers at Microsoft for everything from the JFK assassination to, well, the Modern UI, but usually OS problems can be traced to buggy applications and drivers rather than the OS itself. Don't get us wrong, there are still many, many bugs in Windows' probably more than 50 million lines of code, but blaming Microsoft while throwing your hands in the air with defeat, rather than really investigating the problem, is a cop-out.

3. UNPLUG IT

It's common to begin working on your system with the PSU still plugged in or switched on. People forget that when the PSU is hot, power is still running through the RAM and PCIe slots. It's very little power but there's still a small risk of damaging components when removing parts from the motherboard, so switch off your PSU before you tinker.

4. BLAME THE BUILDER

Wires don't unplug themselves and RAM doesn't back out of a slot. In such cases, it's usually a sign that the original system builder made a boo-boo. If you're a DIYer, like us, you know who gets to eat the turd sandwich.

5. ALWAYS BE GROUNDED

Granted, donning a grounding strap or ESD smock just to pull out a stick of RAM is a tad overkill, but you should at least touch a large metal object such as file cabinet to discharge any built-up static before touching any sensitive electronics.

6. AT THE FIRST HINT OF TROUBLE, BACK UP

When your drive makes one mysterious click or when even a single NAS fan fails, do a complete backup rather than waiting and potentially feeling remorse that you didn't act sooner.

7. WHEN IN DOUBT, REBOOT

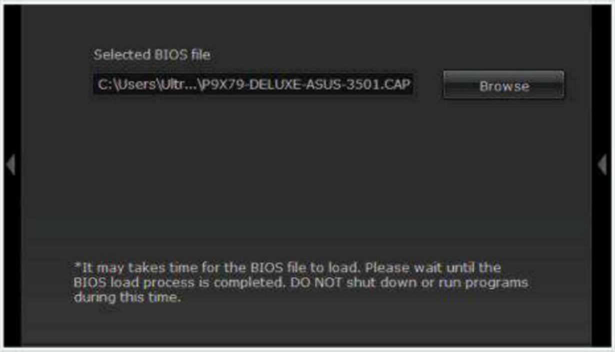
Rebooting will fix more things than you can imagine, especially for those folks who put their PC to sleep rather than shutting down.

8. RETRACE YOUR STEPS

If something just broke, it's usually the last thing that *you* did. So, if you installed a new AV program, a new stick of RAM, or mucked with the registry to improve performance, put the truck in reverse and beep your way back.

9. CHOOSE THE RIGHT TIME FOR MAINTENANCE

Your term paper is due tomorrow morning, so it probably isn't a good time to flash your BIOS and firmware and resize your disk partitions. Rather than turn a standard repair job into a critical emergency, choose the right time for maintenance.



Selected BIOS file: C:\Users\Ultr...\P9X79-DELUXE-ASUS-3501.CAP

*It may takes time for the BIOS file to load. Please wait until the BIOS load process is completed. DO NOT shut down or run programs during this time.

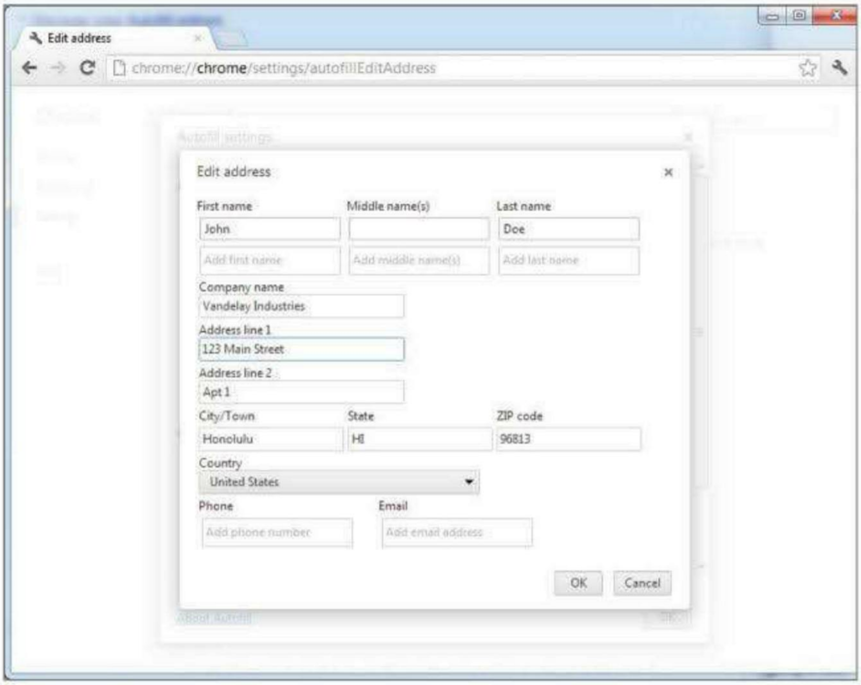
10. MOST HARDWARE PROBLEMS CAN'T BE FIXED

The sad thing about integrated circuits is that 80 percent of hardware issues can't be fixed by you. Sure, you can replace a burst capacitor or bend back a socket pin, but a fried CPU, bad stick of RAM, or disabled SSD can't be fixed no matter how many hours you burn on it. Sometimes, it's better to just know when to fold 'em.

HOW TO

STEP-BY-STEP GUIDES TO IMPROVING YOUR PC

WINDOWS TIP



Edit address

chrome://chrome/settings/autofillEditAddress

Edit address

First name: John

Middle name(s):

Last name: Doe

Company name: Vandelay Industries

Address line 1: 123 Main Street

Address line 2: Apt 1

City/Town: Honolulu

State: HI

ZIP code: 96813

Country: United States

Phone: Add phone number

Email: Add email address

CUSTOMIZE YOUR CHROME AUTOFILL

If you're frustrated with Chrome getting your "Autofill" personal information wrong, or suggesting out-of-date address and credit card info, you can manually edit the information. You can find it in the Chrome Settings menu if you click Show Advanced Settings. Look under Passwords and Forms for the link marked Manage Autofill Settings.

ALEX CASTLE

CONTRIBUTING EDITOR

DO YOU REALLY NEED SYNC?

LATELY I'VE been thinking a lot about cloud storage, and I've realized something interesting: For a lot of people, a file-sync program like Dropbox might not be the best choice. I've personally been a big proponent of sync, but it's got a few drawbacks.

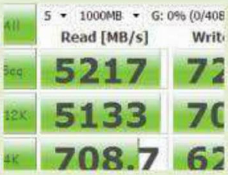
For one, to use Dropbox, you have to have an extra process running on your PC at all times, and if there's one thing I love more than file sync, it's an empty process manager. Second, for a lot of people sync is simply unnecessary. If you only use one computer, or you don't have a lot of files you need instant access to from anywhere, you probably don't need it.

Of course, your data should still be safe in the cloud—I'm just saying that scheduled online backup could be a better choice. You can get much better per-gigabyte pricing with a non-syncing service like Mozy, Carbonite, or even Amazon's business-oriented S3.

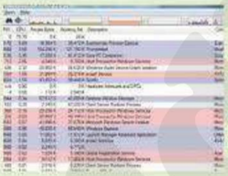
MAKE - USE - CREATE

72 Improve Your Wi-FI Signal

74 Sideload Android Apps



75 Setup a RAMDisk



76 Investigate System Hang-Ups

Microsoft Store
WINDOWS 7 USB/DVD DOWNLOAD TOOL
Step 3 of 4: Insert USB device

80 Install Windows 8 Via USB Key

↘ submit your How To project idea to: comments@maximumpc.com

WorldMags

Improve Your Wi-Fi Signal

YOU'LL NEED THIS

A WIRELESS NETWORK
Sorry, Ethernet users, these tips will only speed up a Wi-Fi network.

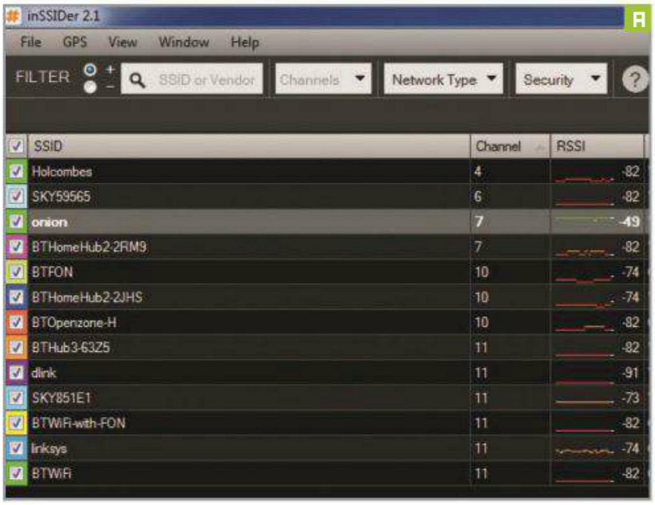
INSSIDER
This Wi-Fi network analyzer is available for free at bit.ly/22nvUo.

THERE ARE LOADS of ways to get a faster wireless network connection. You can knock down walls in your house so the signal can travel more efficiently. You can chuck your current network hardware and buy a whole new set. Or you could go down the easier, free route of making sure your network is operating on the right channel and tweaking its settings for maximum speed. It's like tuning a radio to a different station.

There's a simple reason you might need to change your network channel. When there are many other wireless networks in your local area, signals can clash, causing interference that makes network traffic slow down. There are several possible channels a wireless network can operate on. We're going to look at the traffic in your area and move your network to the least-clogged channel, ensuring you'll get the best results. –**ALEX COX**

1 **GET STARTED** To analyze your local network traffic in greater depth, we're going to use a tool called inSSIDer. It's a full, open-source network analyzer capable of some incredibly complex things, but we're really only going to skim the surface of its abilities. Download the installer from bit.ly/22nvUo and run it—just click Next repeatedly to get it installed.

» Run inSSIDer—you'll find it inside a folder called Metageek in your Start menu. Click the tab marked "2.4GHz channels," then look at the top of the screen for a button labeled Start. This sets inSSIDer hunting around your local area for networks. It'll likely find many more than Windows would normally bring up (**image A**). Make sure you click Stop when you're done.



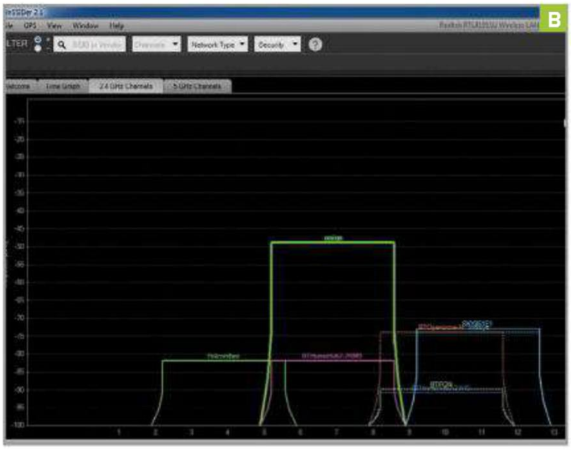
☑ SSID	Channel	RSSI
☑ Holcombes	4	-82
☑ SKY59565	6	-82
☑ onion	7	-49
☑ BTHomeHub2-2RM9	7	-82
☑ BTFON	10	-74
☑ BTHomeHub2-2JHS	10	-74
☑ BTOpenzone-H	10	-82
☑ BTHub3-63Z5	11	-82
☑ dlink	11	-91
☑ SKY851E1	11	-73
☑ BTWiFi-with-FON	11	-82
☑ linksys	11	-74
☑ BTWiFi	11	-82

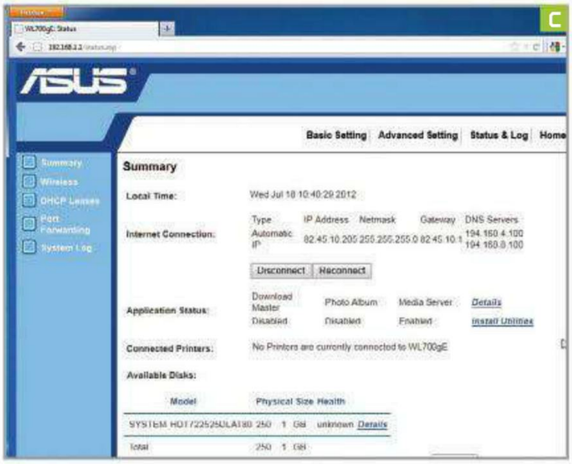
2 **CHANGE THE CHANNEL** Look at the graph the program presents you (**image B**). This is a map of where the networks in your area fall along the 11 main wireless channels, their height representing their signal strength from your current location. It's up to you to interpret your own graph, since it won't be the same as ours. Find an area with some empty space, or find a quiet channel, and write down its number.

» The channel you've picked out will be your network's new home. If it's nice and clear, you should get a decent boost in speed out of it. But to change the channel on your wireless router, you're going to need to log in to its admin interface, and that's different for every router. We'll show you the steps we took on our Asus WL-700ge—you may need to search the Internet for specifics about your own model.

» Start by firing up a web browser—any will do—and go to the local IP address of the wireless router, in this case 192.168.1.1. This brings up the login screen of the router, where you'll need to enter your login credentials. If you don't know yours, it's likely they're still at their defaults, so dig out the manual or search on the Internet and you should be able to gain access (**image C**).

» From here you need to access the Advanced Setting screen, as the basic wireless settings don't offer the option to change the channel. It's rather simple on this router to change the channel—there's a drop-down box in the middle of the screen that lets us do it (**image D**). Again, your router will have a different settings menu, but the process should be quite similar. While we're poking around, we can also look for a number of other settings that will keep the router speedy.




C
WL700gE: Status
192.168.1.1/status.asp
ASUS
Basic Setting
Advanced Setting
Status & Log
Home
Summary
Wireless
DHCP Leases
Port Forwarding
System Log
Disconnect
Reconnect
Details
Install Utilities

Summary

Local Time: Wed Jul 18 10:40:29 2012

Internet Connection:

Type	IP Address	Netmask	Gateway	DNS Servers
Automatic IP	82.45.10.205	255.255.255.0	82.45.10.1	194.168.4.100 194.168.8.100

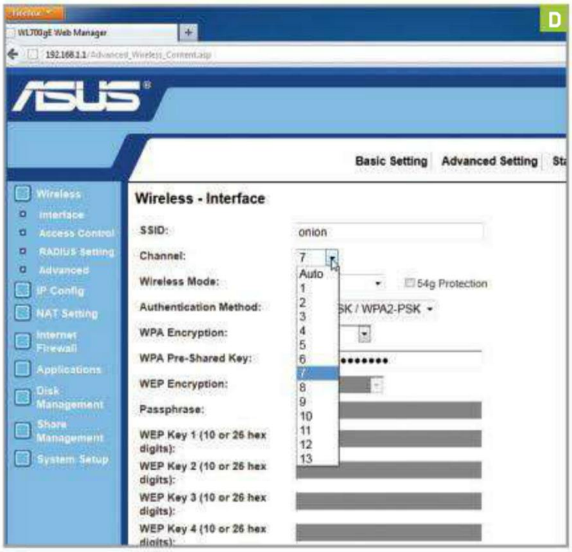
Application Status:

Download Master	Photo Album	Media Server
Disabled	Disabled	Enabled

Connected Printers: No Printers are currently connected to WL700gE

Available Disks:

Model	Physical Size	Health
SYSTEM HDT722525DLA380	250 1 GB	unknown
Total	250 1 GB	


D
WL700gE Web Manager
192.168.1.1/Advanced_Wireless_Content.asp
ASUS
Basic Setting
Advanced Setting
Sta
Wireless
Interface
Access Control
RADIUS Setting
Advanced
IP Config
NAT Setting
Internet Firewall
Applications
Disk Management
Share Management
System Setup
Auto
1
2
3
4
5
6
7
8
9
10
11
12
13

Wireless - Interface

SSID: onion

Channel: 7

Wireless Mode:

☐ 54g Protection

Authentication Method: …SK / WPA2-PSK

WPA Encryption:

WPA Pre-Shared Key: •••••••

WEP Encryption:

Passphrase:

WEP Key 1 (10 or 26 hex digits):

WEP Key 2 (10 or 26 hex digits):

WEP Key 3 (10 or 26 hex digits):

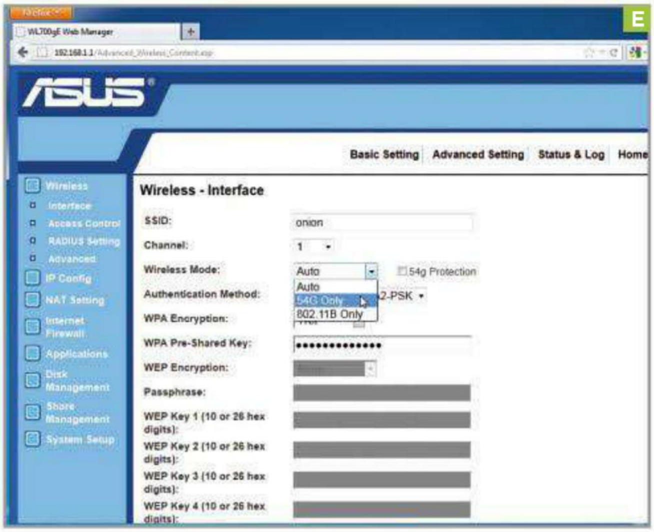
WEP Key 4 (10 or 26 hex digits):

3 **MAKE FURTHER CHANGES** You're also given the option of setting a wireless mode, in this case choosing to turn off the older 802.11b service (image E). If you still have devices that use it, you'll want to leave it switched on, but if you only have modern 802.11g devices in your house, you can safely switch the mode and claw back the tiniest fraction of a speed boost. Then it's time to head to the advanced wireless page.

» Here you can fiddle with all sorts of things, but we'll stick to the bits we know are going to help wireless speed. Turning up the radio power should provide better signal at a distance, so we'll do that. Turning on the "afterburner" mode is only useful if you have wireless cards or dongles in your computers that support it, so we'll leave it off. And frame burst, lower down the page, is a must.

» After you've made the changes, you'll need to apply them and save your settings. Your router will probably reboot at this point (image F). Once everything has come back online, run inSSIDer again to check the results of your changes and ensure that your wireless connection has moved from its original channel to its new home. Try a download—you should see the benefits immediately.

» So you've checked out the wireless channels in your area, found the ideal one for your network, and hopefully—depending on your router—switched its channel to some empty space. If it seems to have made things worse, there may be some other interference—a cordless phone, for example—in your new channel, so try a few until you find the best one.


E
WL700gE Web Manager
192.168.1.1/Advanced_Wireless_Content.asp
ASUS
Basic Setting
Advanced Setting
Status & Log
Home
Wireless
Interface
Access Control
RADIUS Setting
Advanced
IP Config
NAT Setting
Internet Firewall
Applications
Disk Management
Share Management
System Setup
Auto
54G Only
802.11B Only

Wireless - Interface

SSID: onion

Channel: 1

Wireless Mode: Auto

☐ 54g Protection

Authentication Method: …2-PSK

WPA Encryption:

WPA Pre-Shared Key: ••••••••••••••

WEP Encryption:

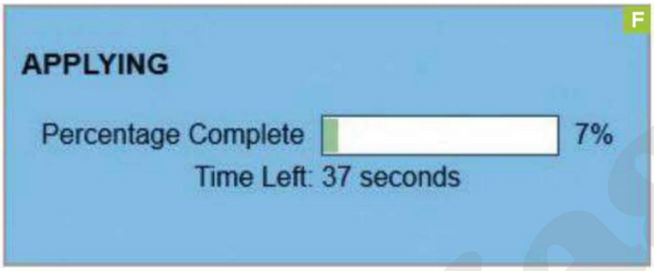
Passphrase:

WEP Key 1 (10 or 26 hex digits):

WEP Key 2 (10 or 26 hex digits):

WEP Key 3 (10 or 26 hex digits):

WEP Key 4 (10 or 26 hex digits):



APPLYING

Percentage Complete 7%

Time Left: 37 seconds

WorldMags

Sideload Android Apps

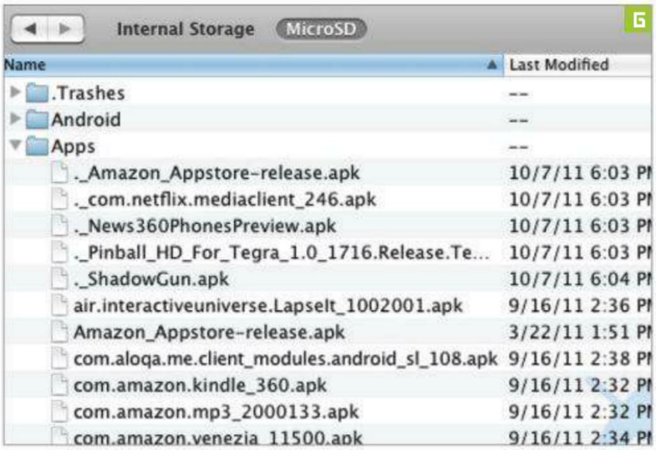
–Markkus Rovito

YOU'VE FOUND that hot new app on the Android Market, and you can't wait to click the Install button. But you're getting the message that the app isn't compatible with your device. Being the good Maximum user that you are, you'd rather find out for yourself. Those messages are sometimes wrong, after all. Or perhaps you want to take advantage of the daily giveaways in the Amazon Appstore. Or, if you're one of the millions of Kindle Fire owners, you may want more choices than the limited Amazon Appstore provides. All of the above comprise sufficient reason to start sideloading apps to your Android device.

1 GET SOME APPS TO SIDELOAD

The reason you sideload apps in the first place is because you're sourcing them from a place other than the sanctioned method, which is usually the Android Market or some device-specific boutique app store. Android Apps come in the form of .apk files. You can procure such files from a prior device backup, straight from a developer's website, and of course from... the Internet (you know the deal).

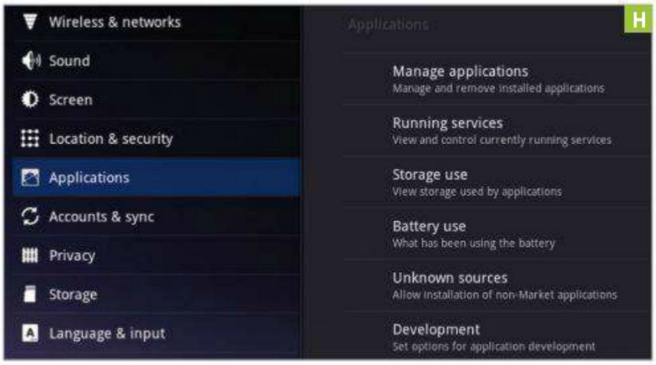
» Next, transfer those .apk files from your PC to your Android however you like: on a microSD card (**image G**), through a cloud service such as Dropbox, via a USB transfer, etc. Just remember what directory those files end up in, so you don't have to root through too many folders looking for them later.



Name	Last Modified
.Trashes	--
Android	--
Apps	--
._Amazon_Appstore-release.apk	10/7/11 6:03 P
._com.netflix.mediaclient_246.apk	10/7/11 6:03 P
._News360PhonesPreview.apk	10/7/11 6:03 P
._Pinball_HD_For_Tegra_1.0_1716.Release.Te...	10/7/11 6:03 P
._ShadowGun.apk	10/7/11 6:04 P
air.interactiveuniverse.LapseIt_1002001.apk	9/16/11 2:36 P
Amazon_Appstore-release.apk	3/22/11 1:51 P
com.aloqa.me.client_modules.android_sl_108.apk	9/16/11 2:38 P
com.amazon.kindle_360.apk	9/16/11 2:32 P
com.amazon.mp3_2000133.apk	9/16/11 2:32 P
com.amazon.venezia_11500.apk	9/16/11 2:34 P

2 TWEAK APPLICATIONS SETTINGS

The default setting in Android is to not allow the installation of non-Market applications. Fie on that! Go to your Android device's Settings, and under Applications, check the "Unknown sources" box (**image H**), allowing you, in effect, to sideload. Some unfortunate souls may have tyrannical devices that have modded the Android OS to not allow sideloading at all, in which case they'll have to look into rooting the device or installing custom Android ROMs. But that's a whole other How To.



Manage applications
Manage and remove installed applications

Running services
View and control currently running services

Storage use
View storage used by applications

Battery use
What has been using the battery

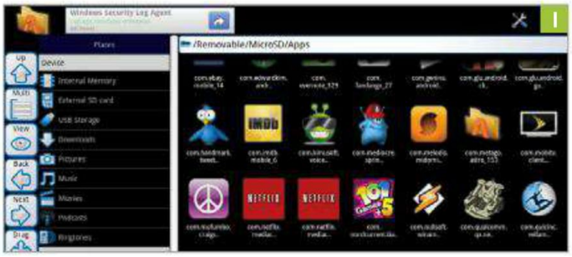
Unknown sources
Allow installation of non-Market applications

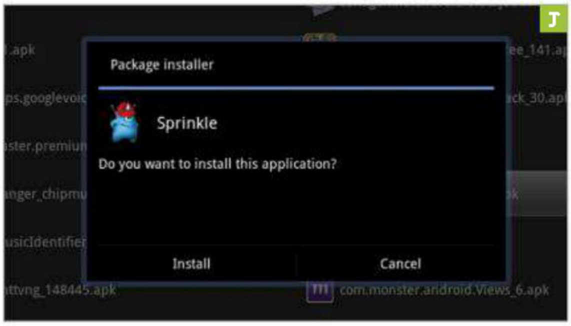
Development
Set options for application development

3 INSTALL THE APPS THROUGH A FILE MANAGER

To install your .apk apps, you essentially launch the files through a file manager app. Many Android devices come with a file manager preloaded. For the rest, there are tons of file managers out there and a good handful of high-quality free ones. If you have access to the Android Market, like most Android users, we like Metago's Astro File Manager or Rhythm Software's File Manager HD for Honeycomb tablets. For folks locked into the Amazon Appstore (users of the Grid10, Kindle Fire, etc.), we prefer ES File Explorer.

» Because you heeded our warning to remember what folder your .apk's are in, you just need to launch your file manager and find them (**image I**). If they're on a microSD card, you'll probably need to hit the file manager's Up button a couple of times to find the "Removable" directory. Touching an .apk icon will open the Package Installer, where you can touch the Install button to finish the deed (**image J**). Now that app, whether it will function properly or not, is ready to launch. Enjoy the sweet freedom of the gray market! ⏻





Package installer

Sprinkle

Do you want to install this application?

Install Cancel

Get Insanely Fast Storage with a RAMDisk –Alex Castle

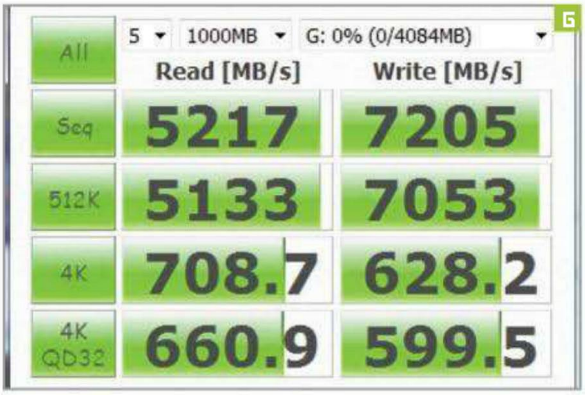
WHEN YOU GET DOWN to it, memory is memory. Your hard disks, SSDs, RAM, and even CPU cache are all structurally and functionally very different, but they still do the same thing—store ones and zeroes. Each type of memory is well suited for its particular job, but there are times when you might want to use them a little differently.

That's the case with a page file, which uses your slower secondary memory to extend your RAM. However, these days, RAM has gotten so cheap and so plentiful that a page file is rarely used. Instead, you should consider the reverse: You can use extra space in your RAM to extend your computer's filesystem using RAMDisk software.

1 **SHOULD YOU USE A RAMDISK?** There are big advantages to using RAM as a hard disk, and none are bigger than the speed boost you'll get by switching to RAM. RAM is fast memory, and in our benchmarks a RAMDisk performed reads and writes at nearly 10 times the speed of even a top-quality SSD (**image G**). That's fast.

» The disadvantages of a RAMDisk are capacity and volatility: Capacity, because RAM just isn't very big, normally. That's what has kept us from using RAMDisk in the past, but now that 32GB of RAM is a very affordable option for your PC, you should have enough to spare for a modest-size RAMDisk. The volatility issue is that RAM gets cleared out every time it powers down. Most RAMDisk software has the option to write to an image file on system shutdown or on a timer, but you'll always run the risk of losing recently saved data in a power outage.

» So, generally speaking, a RAMDisk is a great option for someone who needs small amounts of very fast storage on a temporary basis. Video editing and encoding are great examples of this, as is editing large batches of photos.



G

All	5 · 1000MB · G: 0% (0/4084MB)	
	Read [MB/s]	Write [MB/s]
Seq	5217	7205
512K	5133	7053
4K	708.7	628.2
4K QD32	660.9	599.5

2 **INSTALL A RAMDISK** There are multiple RAMDisk software packages available, but we recommend that you start out with DataRAM RAMDisk (bit.ly/ZeEZ3). It's not the most fully featured product available, but it's got the big advantage of being free for disks up to 4GB. It's also easy to install and use, so it makes a great option for trying out a RAMDisk, and deciding if it's something you'd like to use.

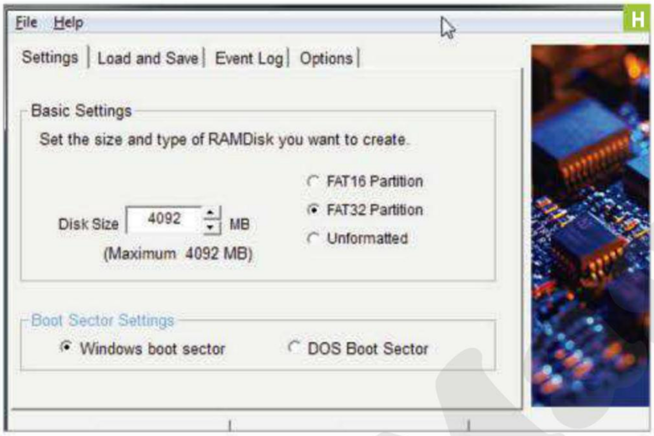
» Another example of RAMDisk software is SuperSpeed RamDisk (www.superspeed.com), which has a better feature set, but the free version is only a trial, and an upgrade costs $50—more than the $15 it costs to upgrade DataRAM RAMDisk.

» Download DataRAM RAMDisk and run the .msi file to install the software.

3 **CONFIGURE YOUR RAMDISK** After you've installed the software, open the Start menu, navigate to the DataRAM RAMDisk folder, and launch the Configuration Utility. The configuration program will open, and you'll be able to choose what you want your RAMDisk to look like. In the first tab you'll be able to choose the size and filesystem for your RAMDisk to use (**image H**). Select as much memory as you want to use (remembering that the free version only allows up to 4GB of space) and pick the FAT32 filesystem.

» The second tab lets you configure the RAMDisk's image file, which allows it to persist even if you shut down your PC (**image I**). We strongly recommend that you tick the checkbox for the second section, so that your RAMDisk will save to a file on system shutdown. Next time you use the RAMDisk you can select the first checkbox and load that file.

» Once you've done all that, click the button at the bottom of the window to start the RAMDisk. Even if you close the configuration utility, your system will still see the RAMDisk. Load a storage benchmark, and marvel at the insane speeds. ⏻



H

Basic Settings

Set the size and type of RAMDisk you want to create.

Disk Size 4092 MB

(Maximum 4092 MB)

○ FAT16 Partition

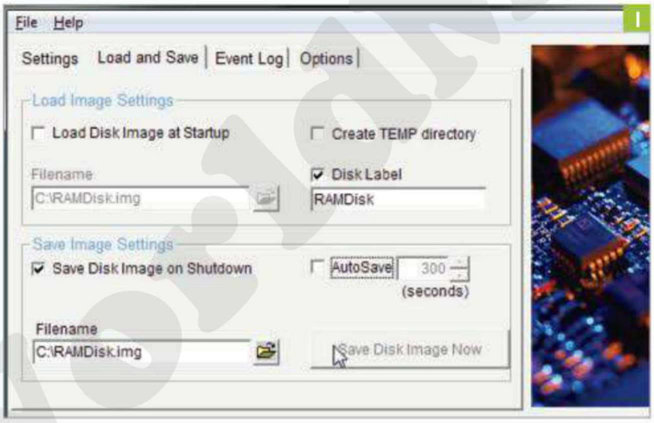
● FAT32 Partition

○ Unformatted

Boot Sector Settings

● Windows boot sector

○ DOS Boot Sector



I

Load Image Settings

☐ Load Disk Image at Startup

☐ Create TEMP directory

Filename C:\RAMDisk.img

☑ Disk Label RAMDisk

Save Image Settings

☑ Save Disk Image on Shutdown

☐ AutoSave 300 (seconds)

Filename C:\RAMDisk.img

WorldMags

Investigate System Hang-Ups with Process Explorer

YOU'LL NEED THIS

PROCESS EXPLORER A more powerful alternative to the standard Task Manager, Process Explorer is available for free at http://bit.ly/G1ydL.

ALL MY APPLICATIONS are closed, so why is my PC's fan suddenly blowing like an asthmatic elephant? Something is driving the processor hard, but what could it be? Have my antivirus defenses been breached? How do I find out what's going on?

Deep at the heart of Windows lies the system scheduler. Easily the most complex and busy part of the operating system, this lump of impenetrable code controls access to system resources. It's the best place to see what's happening and whether it's legitimate. For serious investigation, though, the built-in Task Manager isn't enough. We need something with more precision and scope.

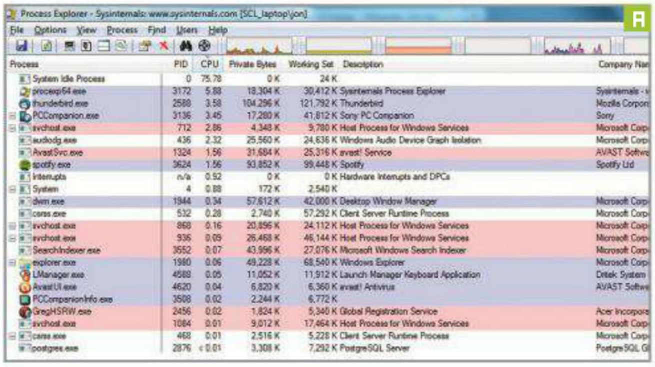
We need the free Process Explorer tool by Mark Russinovich. This Microsoft-supported stand-alone program is exactly what we want to delve safely into the heart of the operating system. –JON THOMPSON

1

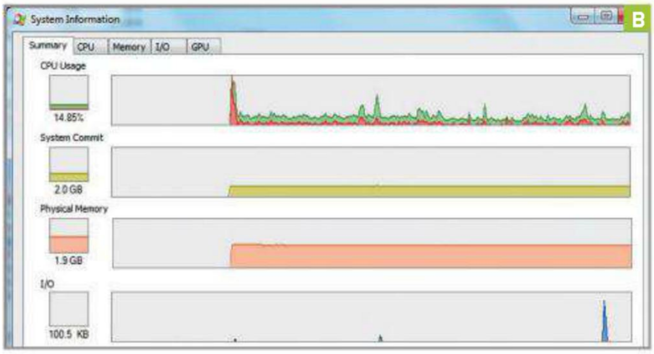
GET STARTED The first step is to get Process Explorer, which you can find at http://bit.ly/G1ydL. It doesn't need installing, so once you've downloaded it, you can easily carry it with you on a USB stick to diagnose problems on other people's PCs. Click Download and a zip file opens. Create a folder somewhere convenient and drag the rocexp.exe file into it.

» To get a good look at the system scheduler, we need to run Process Explorer with Administrator rights. To do so, right-click the procexp.exe file and select Run as Administrator. A security pop-up will appear, asking you to confirm your decision. Click Yes and the main Process Explorer interface will appear (**image A**). Maximize the window to see the most system information.

» Click View > System Information and a window pops up showing current resource use (**image B**). There are several tabs, which give overviews of different parts of the OS and its processing hardware. On multicore systems, you should see multiple traces—one for each core.


A
Process Explorer - Sysinternals: www.sysinternals.com [SCL_laptop\jon]
File Options View Process Find Users Help

Process	PID	CPU	Private Bytes	Working Set	Description	Company Nam
System Idle Process	0	75.78	0 K	24 K		
procexp64.exe	3172	5.88	18,304 K	30,412 K	Sysinternals Process Explorer	Sysinternals -
thunderbird.exe	2588	3.58	104,296 K	121,792 K	Thunderbird	Mozilla Corpor
PCCompanion.exe	3136	3.45	17,280 K	41,812 K	Sony PC Companion	Sony
svchost.exe	712	2.86	4,348 K	9,780 K	Host Process for Windows Services	Microsoft Corp
audiodg.exe	436	2.32	25,560 K	24,636 K	Windows Audio Device Graph Isolation	Microsoft Corp
AvastSvc.exe	1324	1.56	31,684 K	25,316 K	avast! Service	AVAST Softw
spotify.exe	3624	1.56	93,852 K	99,448 K	Spotify	Spotify Ltd
Interrupts	n/a	0.92	0 K	0 K	Hardware Interrupts and DPCs	
System	4	0.88	172 K	2,540 K		
dwm.exe	1944	0.34	57,612 K	42,000 K	Desktop Window Manager	Microsoft Corp
csrss.exe	532	0.28	2,740 K	57,292 K	Client Server Runtime Process	Microsoft Corp
svchost.exe	868	0.16	20,896 K	24,112 K	Host Process for Windows Services	Microsoft Corp
svchost.exe	936	0.09	26,468 K	46,144 K	Host Process for Windows Services	Microsoft Corp
SearchIndexer.exe	3552	0.07	43,996 K	27,076 K	Microsoft Windows Search Indexer	Microsoft Corp
explorer.exe	1980	0.06	49,228 K	68,540 K	Windows Explorer	Microsoft Corp
LManager.exe	4588	0.05	11,052 K	11,912 K	Launch Manager Keyboard Application	Dritek System
AvastUI.exe	4620	0.04	6,820 K	6,360 K	avast! Antivirus	AVAST Softw
PCCompanionInfo.exe	3508	0.02	2,244 K	6,772 K		
GregHSRW.exe	2456	0.02	1,824 K	5,340 K	Global Registration Service	Acer Incorpora
svchost.exe	1084	0.01	9,012 K	17,464 K	Host Process for Windows Services	Microsoft Corp
csrss.exe	468	0.01	2,516 K	5,228 K	Client Server Runtime Process	Microsoft Corp
postgres.exe	2876	< 0.01	3,308 K	7,292 K	PostgreSQL Server	PostgreSQL G



2

INVESTIGATE PROCESSES If CPU use seems high, Process Explorer can tell you which application is hogging it. On the main screen, click CPU and the display sorts itself by the amount of CPU time taken. Processes should pop to the top of the list for a few seconds each. If a process stays at the top, this indicates high CPU use.

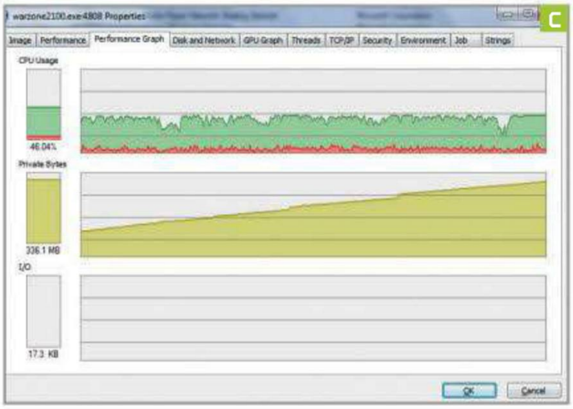
» Click the Process heading to see which processes are running. Scroll to the bottom of the display to see those started under Explorer—highlighted in pale blue. These are the applications you're currently using, and the background processes that are started when you log in.

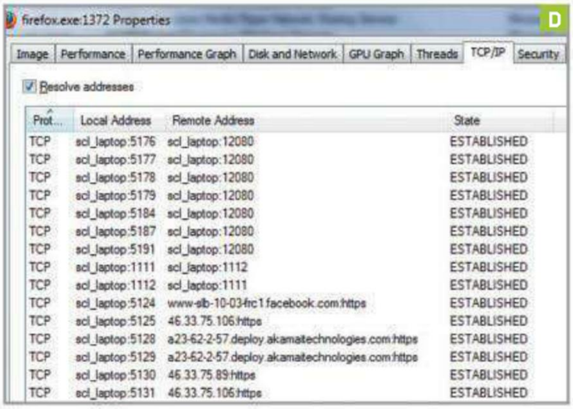
» Right-click a running process and select Properties. This brings up a window containing a detailed view of the process, split into several tabs. The performance graph (**image C**) is great for telling you if the process is taking too many resources and whether that use is increasing. Steadily mounting memory use might be a sign of memory leakage (taking memory, but not giving it back when finished with it).

» Process Explorer has a handy way of identifying a running process. First, bring the application in question to the front of your desktop. Next, in Process Explorer, drag the target icon at the top of the interface onto the application in question. This temporarily minimizes Process Explorer and displays the application you selected. Drop the icon over the application and its process will be selected in Process Explorer.

» When a new process begins, it can be hard to spot it in Process Explorer's list. To make new processes easier to find, click View > Scroll to New Processes. When a new process begins, the display will then scroll to it and highlight it for you in green. Uncheck the option to switch off this feature when you want a more stable display.

» Some malware connects to the outside world, and we can find out which websites it's linking to. Right-click a process and select Properties. On the resulting window, click the TCP/IP tab (**image D**). Ensure that the "Resolve addresses" button is ticked and expand the headings to see the websites being connected to. Do they look dodgy? If so, it could be time for a full system scan.


C
warzone2100.exe:4808 Properties
Image | Performance | Performance Graph | Disk and Network | GPU Graph | Threads | TCP/IP | Security | Environment | Job | Strings
CPU Usage
46.04%
Private Bytes
336.1 MB
I/O
17.3 KB
OK
Cancel


D
firefox.exe:1372 Properties
Image | Performance | Performance Graph | Disk and Network | GPU Graph | Threads | TCP/IP | Security

☑ Resolve addresses

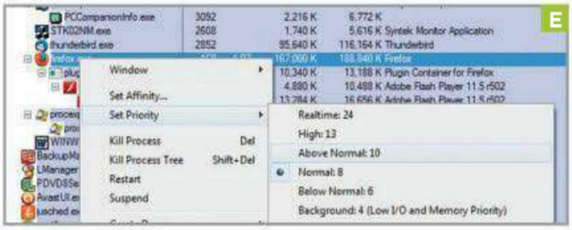
Prot...	Local Address	Remote Address	State
TCP	scl_laptop:5176	scl_laptop:12080	ESTABLISHED
TCP	scl_laptop:5177	scl_laptop:12080	ESTABLISHED
TCP	scl_laptop:5178	scl_laptop:12080	ESTABLISHED
TCP	scl_laptop:5179	scl_laptop:12080	ESTABLISHED
TCP	scl_laptop:5184	scl_laptop:12080	ESTABLISHED
TCP	scl_laptop:5187	scl_laptop:12080	ESTABLISHED
TCP	scl_laptop:5191	scl_laptop:12080	ESTABLISHED
TCP	scl_laptop:1111	scl_laptop:1112	ESTABLISHED
TCP	scl_laptop:1112	scl_laptop:1111	ESTABLISHED
TCP	scl_laptop:5124	www-slb-10-03-frc1.facebook.com:https	ESTABLISHED
TCP	scl_laptop:5125	46.33.75.106:https	ESTABLISHED
TCP	scl_laptop:5128	a23-62-2-57.deploy.akamaitechnologies.com:https	ESTABLISHED
TCP	scl_laptop:5129	a23-62-2-57.deploy.akamaitechnologies.com:https	ESTABLISHED
TCP	scl_laptop:5130	46.33.75.89:https	ESTABLISHED
TCP	scl_laptop:5131	46.33.75.106:https	ESTABLISHED

3

TWEAK, KILL, AND RESTART PROCESSES If you have a game or another demanding application running, you can boost its priority in the system scheduler. To do so, right-click its process and select Set Priority (**image E**). Applications are normally set to Normal, but increasing this to Above Normal will increase its availability to the CPU. Don't be tempted to set priority to Realtime or you may lock up the system!

» There's nothing worse in Windows 7 than a process that suddenly "ghosts out" and the dread words "Not responding" appear in its window title. Instead of simply killing it or waiting for it to die, you can try restarting the process. To do so, find it in Process Explorer, then right-click it and select Restart. This will tell the scheduler to free the process's resources and start again.

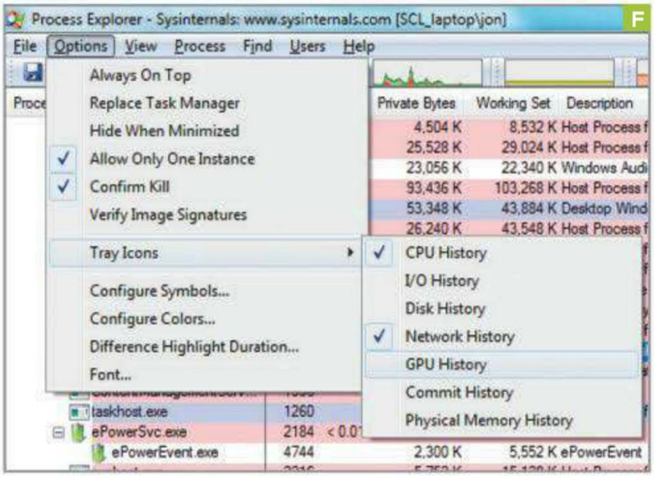
» On a multicore system, a process that uses 100 percent CPU will usually do so using only one core. The others are free to run Process Explorer, so you can still kill the offending code and free up the system to reboot it properly. Right-click the process and select Kill Process. Confirm that you want to kill it and the process will end.

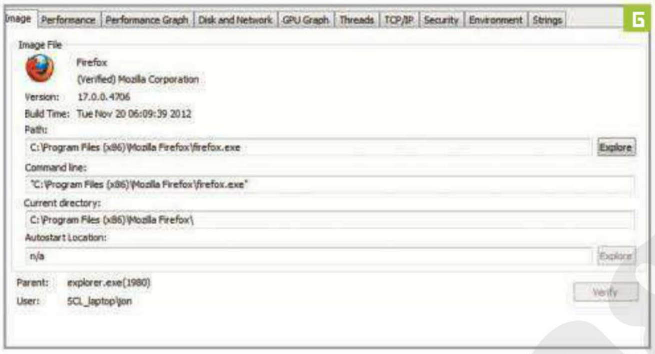

E
PCCompanionInfo.exe 3092 2,216 K 6,772 K
STK02NM.exe 2608 1,740 K 5,616 K Syntek Monitor Application
thunderbird.exe 2852 95,640 K 116,164 K Thunderbird
firefox 167,000 K 188,840 K Firefox
10,340 K 13,188 K Plugin Container for Firefox
4,880 K 10,488 K Adobe Flash Player 11.5 r502
13,284 K 16,656 K Adobe Flash Player 11.5 r502
Window
Set Affinity...
Set Priority
Kill Process Del
Kill Process Tree Shift+Del
Restart
Suspend
Realtime: 24
High: 13
Above Normal: 10
● Normal: 8
Below Normal: 6
Background: 4 (Low I/O and Memory Priority)

4

EXPLORE OTHER FEATURES When Process Explorer is running, you'll see a small graph of CPU use in the system tray of the Windows taskbar. You can add other graphs here for handy reference by clicking Options > Tray Icons and selecting what you need (**image F**). Note that these only appear when Process Explorer is running. If you hover the mouse over a graph, you'll be presented with more details.

» Having delved into your running operating system, it's very useful to make sure that nothing has tampered with an application's code. To do so, right-click the application and select Properties. In the Image tab (**image G**), click the Verify button. If the producer is available, this will compare the .exe with a check code and the word Verified will appear next to the vendor's name.


F
Process Explorer - Sysinternals: www.sysinternals.com [SCL_laptop\jon]
File Options View Process Find Users Help
Always On Top
Replace Task Manager
Hide When Minimized
✓ Allow Only One Instance
✓ Confirm Kill
Verify Image Signatures
Tray Icons
Configure Symbols...
Configure Colors...
Difference Highlight Duration...
Font...
✓ CPU History
I/O History
Disk History
✓ Network History
GPU History
Commit History
Physical Memory History
Private Bytes Working Set Description
4,504 K 8,532 K Host Process f
25,528 K 29,024 K Host Process f
23,056 K 22,340 K Windows Audi
93,436 K 103,268 K Host Process f
53,348 K 43,884 K Desktop Wind
26,240 K 43,548 K Host Process f
taskhost.exe 1260
ePowerSvc.exe 2184 < 0.01
ePowerEvent.exe 4744 2,300 K 5,552 K ePowerEvent


G
Image | Performance | Performance Graph | Disk and Network | GPU Graph | Threads | TCP/IP | Security | Environment | Strings
Image File
Explore
Explore
Verify

Firefox
(Verified) Mozilla Corporation
Version: 17.0.0.4706
Build Time: Tue Nov 20 06:09:39 2012
Path:
C:\Program Files (x86)\Mozilla Firefox\firefox.exe
Command line:
"C:\Program Files (x86)\Mozilla Firefox\firefox.exe"
Current directory:
C:\Program Files (x86)\Mozilla Firefox\
Autostart Location:
n/a
Parent: explorer.exe(1980)
User: SCL_laptop\jon

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OF SOLUTIONS

Seidon 240M
- Maintenance Free - Factory filled and sealed
- Quiet AIO Liquid Cooler

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- High-End Features - Budget Friendly
- Supports up to 3 radiators

V1000
- Haswell / 4th Gen Intel Core Ready
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Packing full ATX motherboard support, steel reinforced carrying handles, modular features, portability, support for up to 3-way SLI/CrossFire, excellent cooling, and the ability to transform between a LAN Box and Test Bench.

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Operating on a powerful single +12V rail system, i Series makes itself perfectly suited for powering graphics cards and other demanding system components.

V SERIES
V700
V1000
V850
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THE NEW GOLD STANDARD

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The Seidon 120XL is Cooler Master's latest update to its incredibly compact watercooling kit that aims to bring a thick, high performance watercooler to the masses.

Peripherals: Quick Fire Stealth

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Peripherals: Sirus S

Built for gaming enthusiasts and audiophiles alike, the CM Storm Sirus S 5.1 Surround Sound Headset creates an immersive experience with hi-fidelity soundscapes and intense bass.

WorldMags

Install Windows 8 from a USB Drive

YOU'LL NEED THIS

A USB DRIVE
You'll need at least 4GB of space to install Windows 8.

A WINDOWS 8 ISO
You can buy one online at bit.ly/TELHzy or burn one from a Windows 8 install disc.

OVER THE YEARS, Microsoft has made the Windows installation process pretty painless. Once you've set the install application running, it's off to the races: You can sit back, enjoy a nice beverage, and let Microsoft's fantastically efficient OS installation routine do all the work. By the time your Windows 8 OS needs your input, you're practically finished—just a few short steps, if not minutes, away from the tiled joy that is Windows 8 proper.

So, what does that leave us to talk about? Plenty. Ditch your discs, because we're going to show you how to install Windows 8 from a USB key. –DAVID MURPHY

1

PREPARE A USB KEY (THE FAST WAY) If you shun DVDs, love speedier installations, have a digital download of Windows 8, or just plain don't have an optical drive, then it's going to be a USB-based installation for you. And that's just fine; it's a great, quick way to get an operating system onto your hard drive.

» The easiest way to accomplish this process is to already have your hands on a copy of Windows 8's downloadable .iso file—acquirable by purchasing it from Microsoft itself. If you have a flash drive of the appropriate size (at least 4GB or greater, depending on whatever file Microsoft lets you grab), you're golden. Insert your flash drive into a USB slot on your system, and then go grab Microsoft's ill-named Windows 7 USB/DVD Download Tool (bit.ly/gdCUBs).

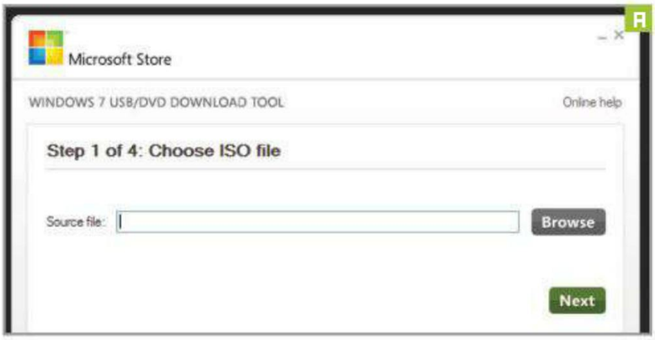
» Install the app and run it. It'll ask you to select an .iso file to be "burnt" onto your USB key (image A). Go ahead and select your Windows 8 .iso file—the fact that it's not the same OS as the tool's name has absolutely no bearing on what you're doing.

» On the next screen, you'll be asked whether you'd like to create a "Windows 7 backup"—again, ignore the name—on a USB device or DVD. Pick the obvious answer, select your USB key from the drop-down menu (image B).

When you're ready to let 'er rip, click "Begin copying!" If the tool needs to format your USB key first, it'll let you know. Couldn't be easier, right?

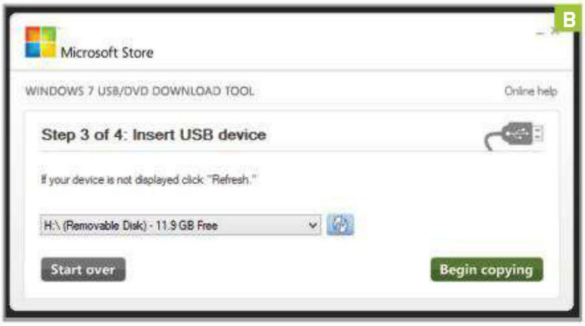
» Sometimes, however, the Windows 7 USB/DVD Download Tool mucks up—it might tell you that the .iso file you're looking to "burn" isn't actually a recognizable .iso file. You know it is; the Windows tool disagrees. That's a problem.

» There are a number of ways around this problem, but the most simple is to do what the Windows 7 USB/DVD Download Tool is doing, by hand. We'll show you how.



Step 1 of 4: Choose ISO file

Source file:



Step 3 of 4: Insert USB device

If your device is not displayed click "Refresh."

H:\ (Removable Disk) - 11.9 GB Free

2

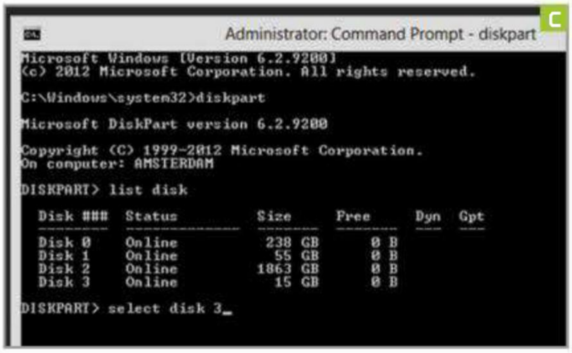
MANUALLY PREPARE A USB KEY Start by using a freeware app like Virtual CloneDrive (bit.ly/zS4p) to mount your downloaded Windows 8 installation .iso to a virtual drive within your current Windows OS. Alternatively, insert a Windows 8 DVD into your optical drive.

» Next, insert your USB key and fire up a command prompt as an Administrator. Within the command prompt, load Windows' built-in Disk Partition utility by typing `diskpart` and hitting Enter.

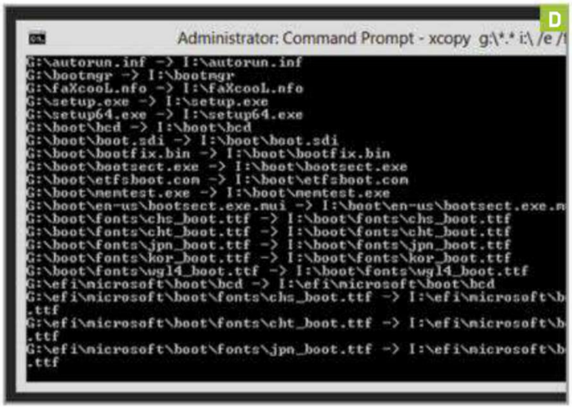
» Within the Disk Partition utility, you'll want to start out by typing `list disk` and hitting Enter. From there, write down the drive number that corresponds to your flash drive—you'll be able to tell, as the capacity of the listed drive should match the capacity of your USB key (image C).

» Next, type `select disk #`, where the pound sign is the drive number of your USB key that you just noted. Hit Enter—DiskPart will select the aforementioned drive. Now, type `clean` and hit Enter to remove any existing partitions that might already be on your flash drive. Once the cleaning process is done, type `create partition primary` and hit Enter to do just that. Type `select partition 1` and hit Enter to select your new partition, type `active` and hit Enter, and then type in `format FS=NTFS quick` to quickly reformat your partition with the NTFS filesystem. Type `assign` and hit Enter, and you'll have finished making your USB key bootable!

» Now, it's time to copy your Windows 8 installation files from their drive—virtual or real—to your USB key. Close diskpart by typing `exit` and hitting Enter. From the command prompt, type `xcopy x:\*.* y:\ /e /f /h`. In our example, however, the "x:\" designation should actually represent the drive letter of your mounted Windows 8 installation .iso file or physical DVD. The "y:\" should be the actual drive letter of your USB key. Once you've made those alterations, hit Enter and let 'er rip—all of the Windows 8 files will start transferring over to your USB key (**image D**).



```
Microsoft Windows [Version 6.2.9200]
(c) 2012 Microsoft Corporation. All rights reserved.

C:\Windows\system32>diskpart

Microsoft DiskPart version 6.2.9200

Copyright (C) 1999-2012 Microsoft Corporation.
On computer: AMSTERDAM

DISKPART> list disk

  Disk ###  Status         Size     Free     Dyn  Gpt
  --------  -------------  -------  -------  ---  ---
  Disk 0    Online          238 GB      0 B
  Disk 1    Online           55 GB      0 B
  Disk 2    Online         1863 GB      0 B
  Disk 3    Online           15 GB      0 B

DISKPART> select disk 3_
```



```
G:\autorun.inf -> I:\autorun.inf
G:\bootmgr -> I:\bootmgr
G:\faXcooL.nfo -> I:\faXcooL.nfo
G:\setup.exe -> I:\setup.exe
G:\setup64.exe -> I:\setup64.exe
G:\boot\bcd -> I:\boot\bcd
G:\boot\boot.sdi -> I:\boot\boot.sdi
G:\boot\bootfix.bin -> I:\boot\bootfix.bin
G:\boot\bootsect.exe -> I:\boot\bootsect.exe
G:\boot\etfsboot.com -> I:\boot\etfsboot.com
G:\boot\memtest.exe -> I:\boot\memtest.exe
G:\boot\en-us\bootsect.exe.mui -> I:\boot\en-us\bootsect.exe.m
G:\boot\fonts\chs_boot.ttf -> I:\boot\fonts\chs_boot.ttf
G:\boot\fonts\cht_boot.ttf -> I:\boot\fonts\cht_boot.ttf
G:\boot\fonts\jpn_boot.ttf -> I:\boot\fonts\jpn_boot.ttf
G:\boot\fonts\kor_boot.ttf -> I:\boot\fonts\kor_boot.ttf
G:\boot\fonts\wgl4_boot.ttf -> I:\boot\fonts\wgl4_boot.ttf
G:\efi\microsoft\boot\bcd -> I:\efi\microsoft\boot\bcd
G:\efi\microsoft\boot\fonts\chs_boot.ttf -> I:\efi\microsoft\b
.ttf
G:\efi\microsoft\boot\fonts\cht_boot.ttf -> I:\efi\microsoft\b
.ttf
G:\efi\microsoft\boot\fonts\jpn_boot.ttf -> I:\efi\microsoft\b
.ttf
```

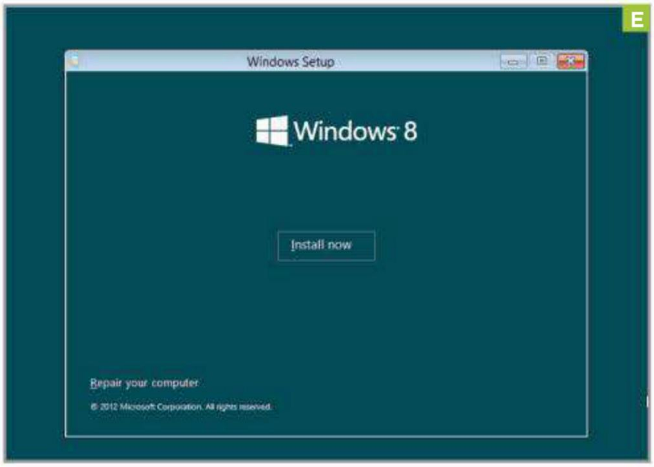
3 INSTALL WINDOWS 8—UPGRADE OR CLEAN?

Once you're ready to install Windows 8 from your USB key, you'll want to restart your computer and either boot into your motherboard's BIOS or hit the associated hotkey that allows you to access the boot menu during POST. Regardless of which way you go about it, you'll want to make sure your system is set to first boot off of your USB key instead of your existing hard drive.

» Be on the lookout to see if your motherboard requires you to hit a key—any key on your keyboard—to confirm that you want to boot to your USB drive. From there, the actual Windows 8 installation process should look a lot like what you're already used to, if you've ever installed Windows 7 or Windows Vista (**image E**).

» And now's as good a time as any to talk about upgrading versus starting from scratch, since you're likely to be presented with both of these options at the very beginning of the Windows 8 installation process.

» Upgrading can be convenient, but a clean install of an operating system is generally the best way to go. Right now, your computer is likely full of crap—applications you once installed and left behind, an old driver version or two that you've forgotten about, and just general OS bloat that can hit a variety of points around your operating system (from your Start menu to your registry). Consider the installation of a new operating system to be kind of like the equivalent of spring cleaning in the real world. It gives you, and your poor PC, a chance to start anew.



WorldMags

BUILD IT

TOM MCNAMARA **ASSOCIATE EDITOR**

Play Crysis 3 on a Budget

We attempt to build the best PC for Crysis 3 without suffering a financial crisis

LENGTH OF TIME: **2 HOURS**

LEVEL OF DIFFICULTY: **INTERMEDIATE**

THE MISSION When the original Crysis dropped six years ago, it quickly became the gold standard for visual splendor—and enthusiast agony. Gamers the world over fired up the demo, only to find their previously potent GPU coughing and sputtering. Thus began The Great Upgrade Rush of 2007, as we all upgraded just to play Crysis, and the game became the benchmark for PC gaming for years to come. Whenever a new GPU arrived, the first question on everyone's mind was, "Will it run Crysis?" When Crysis 2 came along it was a console port, and somewhat scaled-back technologically. The environments were small by PC standards, and developer Crytek didn't expose advanced settings for us to mess with. With Crysis 3, though, Crytek has claimed it would make your PC its bitch, and we must say after benchmarking it that we agree; bitches will be made.

So, for this month's Build It, we set out to tame the beast by putting together a bang-for-the-buck Crysis 3 machine, settling the question of whether or not you need a $500 video card or CPU to run the game at 40-plus frames per second at 1080p. It sounds like a tall order, but we'll talk you through the build, explain all the choices we made, and what mistakes we almost made.

The rugged C70 case makes our Crysis 3 system look battle-ready.

LET'S GET SORTED

AT MAXIMUM PC, we get a steady trickle of $5,000-plus systems that would handle Crysis 3 just fine. But we won't be using any of them for this project since it would be cheating. It would also be easy to go with a Core i5-3570K system, stuffed into a Z77 motherboard. That would perform well out-of-the-box, and the CPU is overclockable. There's just one problem: Intel's next generation of desktop CPUs, codenamed Haswell, are coming out this summer, which means that Z77 is kind of a dead end for enthusiasts at this point. Sure, it would last us a few years but our upgrade options would be slim. Or we could go with an AMD build. Its FX CPUs look impressive on paper, but they have consistently fallen short of a 3570K in most of our benchmarks.

The answer then, both for performance and longevity, appears to be X79, aka Socket LGA 2011. It takes the smokin'-fast Sandy Bridge-E CPUs (*and* Ivy Bridge-E CPUs, expected in late 2013). It also provides enough PCIe lanes to handle multiple GPUs without a bottleneck. With our socket chosen, we settled on the "entry-level" Core i7-3820 CPU for less than $300. We wanted Gigabyte's GA-X79-UD3 mobo, for its combo of price, features, and build quality, but it was in short supply, so we tapped its big brother, the GA-X79-UP4, to act as a stunt double.

For the GPU, we picked an MSI GeForce GTX 670 Power Edition for its balance of performance, price, quiet operation, and features. AMD didn't have quite what we wanted for this build. We chose the Corsair Vengeance C70 for a case, and Cooler Master provided a snazzy Silent Pro M2 720w power supply. We loaded our OS and game files onto a Corsair Neutron GTX SSD, and cooled our CPU with an old standby after abandoning a more ambitious cooling plan.

INGREDIENTS

	PART	URL	PRICE
Case	Corsair Vengeance C70	www.corsair.com	**$120**
PSU	Cooler Master Silent Pro M2 RS720	www.coolermaster.com	**$120**
Mobo	Gigabyte GA-X79-UP4	www.gigabyte.com	**$250**
CPU	Intel Core i7-3820	www.intel.com	**$290**
Cooler	Cooler Master Hyper 212 Evo	www.coolermaster.com	**$30**
GPU	MSI GTX 670 PE	www.msi.com	**$375**
RAM	Corsair 4x 2GB Vengeance	www.corsair.com	**$50**
SSD	Corsair Neutron GTX 240GB	www.corsair.com	**$210**
HDD	Seagate 1TB Barracuda	www.seagate.com	**$70**
OS	MS Windows 7 64-bit OEM	www.microsoft.com	**$100**
Total			**$1,615**

1

THE X FACTOR

THE X79'S I7-3820 is an ideal choice because it has more features than the i7-3770K for about the same price. For example, the latter's Z77 chipset doesn't support more than 16 PCIe 3.0 lanes, while X79 chipset can handle up to 40 PCIe lanes. That gives us enough headroom to add a second GPU without hitting a ceiling. As for AMD, we considered the FX-8350 for its eight unlocked cores and 4GHz stock clocks. But in testing, it's just not as fast as the Core i7s, and its 990FX chipset doesn't support PCIe 3.0, which has twice the bandwidth of PCIe 2.0. Admittedly, the lane thing is irrelevant for a single GPU. A Z77 or 990FX board will have plenty of room for every modern GPU, but we prefer an expandable system.

intel
Core™ i7

2

CASING THE JOINT

WE GAVE Corsair's Vengeance C70 a good review a few months back (8 Verdict, September 2012), so we decided to give it a shot for our Crysis box. The NZXT Phantom 410 was also considered, but we needed to move this case around the office a few times, and the C70's all-metal housing and built-in carrying handles were better suited to the task. Plus, the side panels are latched, so we didn't have to worry about losing thumbscrews. It's also perfectly suitable for our build , with its modest cost and military aesthetic. It's blessed with large fan mounts, quiet stock fans, and lots of airflow, so it should help us with overclocking. We also like that both drive cages can be removed, giving our intake fans an unobstructed path to the parts that need to chill. By default, the two front fans are mounted on the cages. We moved those into the front bezel and removed the top cage. The bezel also has cutouts to feed the fan wiring back inside the cage. We left the bottom cage in place because it was easier to manage the SSD and HDD that way.

WorldMags

3

THE JUICE IS LOOSE

COOLER MASTER'S Silent Pro PSUs are known for running quietly and reliably, so we wanted to try one for this build. The RS720 model we used is the sequel to the original, and has the same great features, including a 135mm fan that dynamically adjusts its speed according to conditions instead of running full-blast all the time. We also like its flat cables, which are more flexible than standard rounded cables. Otherwise, it offers the same high-quality specs, plus four PCIe connectors instead of two, making it easier to run dual GPUs when Crysis 4 arrives. The flat cables made for an easier build, but be warned that this model still uses rounded cables for the motherboard and CPU power.

M2
Silent Pro
720W

4

TAKING A CHILL PILL

ONE DOWNSIDE of having a motherboard that supports quad-SLI is there is very little space between the first PCIe slot and the CPU socket. In fact, we discovered while building this rig that we were unable to use a CPU heatsink bigger than 120mm, which torpedoed our plans to use an NZXT Havik 140 cooler. The Havik 140 is a massive cooler with dual fans in a push-pull config, so we figured it would let us overclock to our heart's content and stay quiet about it. But in practice, it was just too damned big. Sure, we could have installed the Havik, but it would have meant rotating the heatsink 90 degrees, which means that its fans would have been sucking air straight off a sweltering GPU, instead of the cooler air entering the case from the front intake—not a great idea. Undaunted, we decided to use our favorite low-cost CPU cooler, the always-popular Hyper 212 Evo from Cooler Master. It's not sexy but it gets the job done and is quiet, sort of like an intern.

5

THE GPU WAR

MSI KIND OF nailed it with its GeForce GTX 670 Power Edition. Its core clock is bumped up from 915MHz on the stock card to 1,020MHz, which is a slightly higher clock than that of a GTX 680, though the memory clock is left alone. Its boost clock speed of 1,080MHz is also higher than the GTX 680, which lets it keep pace with its big brother despite costing about $100 less. Its proprietary "Twin Frozr IV" cooler has dual fans and a huge heatsink with copper pipes, and it let us overclock the board even further to 1,100MHz core and 1,700MHz for the memory. We could have gone with a Radeon HD 7970, but most of them are voltage-locked and noisy. The GTX 670 Power Edition, meanwhile, is fully tweakable, and we know from past testing that this card will not give us any troubles since it's always been quiet and reliable. So, there's a low potential for frustration, a high potential for performance, and a lack of excessive noise and heat. And since we're playing at 1080p, the HD 7970's additional gigabyte of VRAM and wider data bus aren't significant enough factors to bring us to team Red this time around.

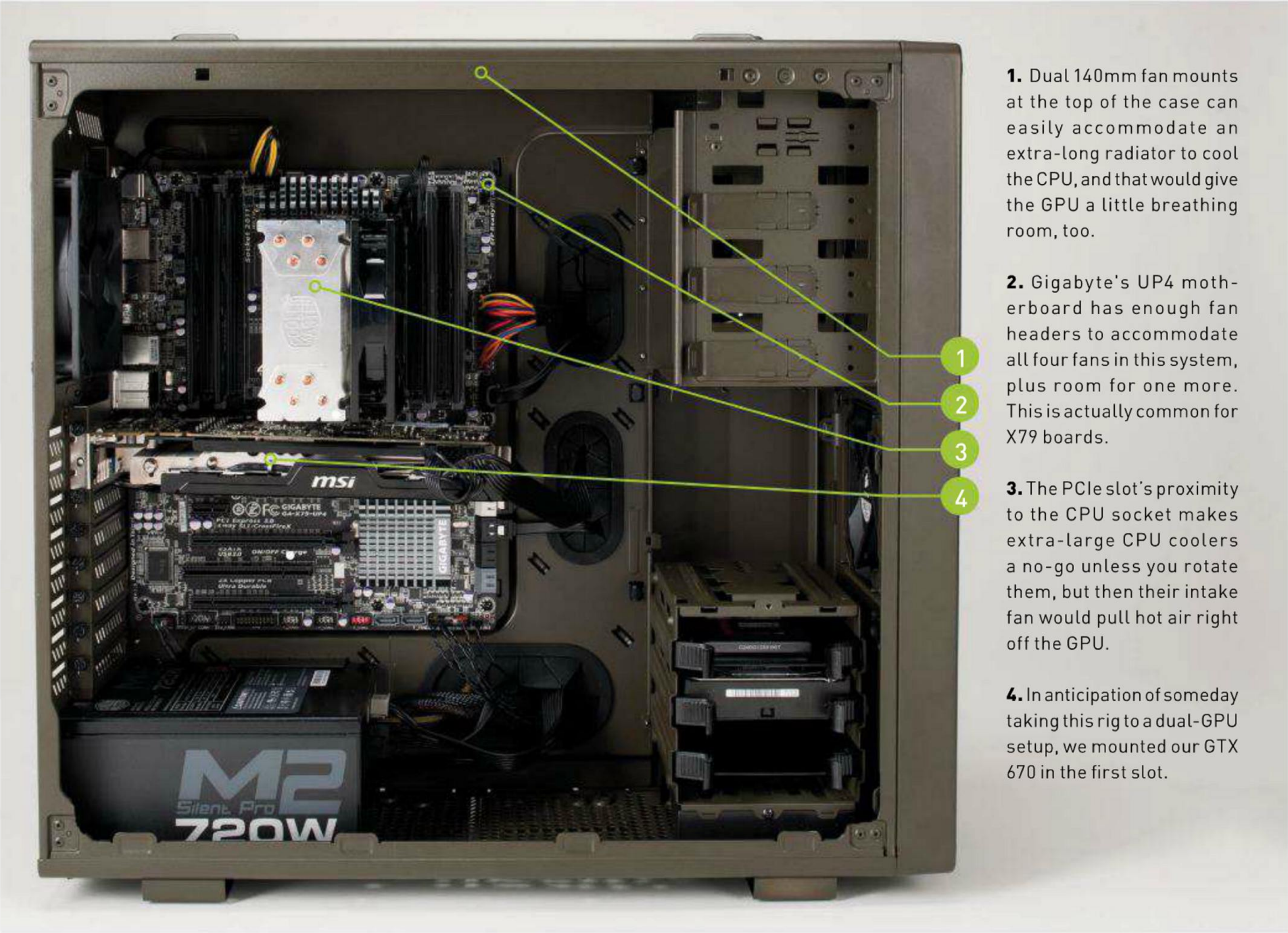
msi
Twin Frozr

6

GOING FOR A DRIVE

AN SSD IS not the cheapest choice for storage, but when you can turn on your computer and be in the desktop in less than 20 seconds (as opposed to just staring at a boot screen while your HDD thrashes around), it's kind of a big deal. Of the current generation of drives, we have the OCZ Vector and Samsung 840 Pro alone at the top, and they cost a pretty penny at around $250–$275 for the 256GB versions. Corsair's Neutron GTX, though, hovers around $200 for the 256GB drive, despite offering nearly the same performance as the class leaders as well as the same 5-year warranty. It's our opinion that once you get to these speeds, you simply won't feel a subjective difference between the top-tier SSDs and the second tier, so why not save a little money? As a bonus, the Corsair's C70 case features slide-out drive trays with mounts for SSDs, so we didn't even need any 3.5-inch conversion kits.

CORSAIR
SATA 3
SOLID-STATE DRIVE
240GB
NEUTRON
GTX



1. Dual 140mm fan mounts at the top of the case can easily accommodate an extra-long radiator to cool the CPU, and that would give the GPU a little breathing room, too.

2. Gigabyte's UP4 motherboard has enough fan headers to accommodate all four fans in this system, plus room for one more. This is actually common for X79 boards.

3. The PCIe slot's proximity to the CPU socket makes extra-large CPU coolers a no-go unless you rotate them, but then their intake fan would pull hot air right off the GPU.

4. In anticipation of someday taking this rig to a dual-GPU setup, we mounted our GTX 670 in the first slot.

IT'S ALL OVER EXCEPT FOR THE CRYSISING

PERHAPS WE over-prepared. Our plan was to maintain over 40fps in Crysis 3 using the game's "High" graphics setting. As it turns out, we nearly hit that mark on "Very High" without even needing to overclock, though we were using 4x SMAA instead of 4x MSAA. The latter did not seem to have an improvement in visual quality that would justify the loss of about 5fps. The machine was also whisper-quiet throughout our testing. You could hear the 670's fans crank up a little, but it wasn't distracting, even when pushed to 1,100MHz core clock (nearly 200MHz above the reference board clock). However, if we were running a 2560x1600 display, the GTX 670 would not cut it. We'd have to get a second GPU for SLI action, as there's simply no way a single GPU other than a GTX Titan could run this game at high settings at that resolution.

Otherwise, the system was a pleasure to build and test. The C70 chassis was roomy, cool, and quiet, though the thumbscrews on the PCI slot covers required a screwdriver to loosen, which kind of defeats the point. Having the intake fans on the drive cages instead of flush against the chassis also doesn't make a lot of sense since they are set back from the front of the case by several inches. But moving those two 120mm units into the front bezel was fairly painless.

We'd like to point out that the Hyper 212 Evo CPU cooler let us take our Core i7 CPU from 3.6GHz to an overclocked 4.25GHz without breaking a sweat or making a peep, despite using just a single 120mm fan. Stock temps were around 30 C idle, with temps dipping into the mid-50s under load. The GPU hovered around 70 C when overclocked—not bad for a core clock running 17 percent faster than stock speed. MSI's copper heat pipes and dual fans helped there, for sure.

Overall, we rate this system a success both in terms of performance gained and money spent. And unlike most of our lab experiments, we *do* recommend you try this at home. A gaming system with these specs will last you at least until Crysis 4 comes out, when we'll do this all over again.

BENCHMARKS

	Stock Speeds	Overclocked	Percent Difference
Crysis 3, "Very High" (fps)	38	42	+10%
Catzilla, 1080p	8,529	9,257	+8%
3DMark 11 Extreme	3,280	3,449	+5%
3DMark 11 Performance	9,204	9,702	+5%
3DMark (2013) Extreme	3,035	3,298	+8%

WoW! eBook

BUILD IT

TOM MCNAMARA **ASSOCIATE EDITOR**

Squeezing the Titan into an ITX Case

Nvidia's newest GPU was built to provide maximum horsepower to SFF rigs, so we built a Mini-ITX system to see if the card would fit, and if it could keep cool and quiet under pressure

LENGTH OF TIME: **4–6 HOURS**

LEVEL OF DIFFICULTY: **INTERMEDIATE**

THE MISSION Nvidia's GeForce GTX Titan video card has a serious cool factor. It's the fastest single-GPU card on the market, for one thing. And it beats the competition without sounding like a fighter jet or getting hot enough to trigger a meltdown. Finally, at 10.5 inches, it's shorter than the reigning single-card champ, the GTX 690, by half an inch, making the Titan suitable for deployment in small form factor (SFF) builds. In fact, when Nvidia launched this card, it specifically pointed out that it was designed for use in SSF rigs, so we just had to see how things would play out in a Mini-ITX environment. And why stop with the card? We figured we might as well throw in a nice CPU, motherboard, a fast SSD, and some extra cooling so we could dabble in overclocking. Even though we started off with the innocent goal of gauging the experience of building a Titan-based SFF rig, in the end we decided to see just how far we could push this tiny system, and came away surprised by how much performance can be had in a rig with such a small footprint.

SilverStone

A PLETHORA OF OPTIONS

WITH OUR GPU already decided, we had to figure out which platform to build around, and going Mini-ITX narrowed our choices considerably. First off, there are no LGA2011 motherboards in that form factor, and second, Intel's new socket 1150 Haswell microarchitecture isn't available as of press time, leaving just AMD or Intel's venerable Socket 1155. Because this is a maximum-performance machine, we went with Intel, especially since we wanted to overclock and we know from experience that we can push a Socket 1155 CPU to 4.4GHz. That push necessitated a large CPU cooler and an overclockable motherboard.

To hold it all, we chose Silverstone's Sugo SG08 case. It's small and tastefully appointed, yet large enough for both our Titan GPU and an aftermarket CPU cooler since its PSU is mounted in the front of the box instead of the rear. There are larger SFF cases that offer more room for fans and wiring, but we wanted to see the Titan sweat a bit, so we went with the Sugo. We also like the fact that it includes a 600W power supply that's customized for the chassis; a very nice touch that we'll discuss later on in more detail.

Wrapping it up we chose an OCZ SSD for our OS drive and a WD hard drive for media storage. We went with a slot-fed optical drive since that is the only type this case accepts and we didn't want the bay to sit empty. Finally, we used a low-profile Silverstone Nitrogon NT06-Pro CPU cooler and Windows 7 Pro.

INGREDIENTS

	PART	URL	PRICE
Case	Silverstone Sugo SG08	www.silverstonetek.com	**$200**
PSU	600W SST-ST60F-SG		**(bundled)**
Mobo	P8Z77-i Deluxe	www.asus.com	**$200**
CPU	Core i7-3770K	www.intel.com	**$325**
Cooler	Nitrogon NT06-Pro	www.silverstonetek.com	**$60**
GPU	GeForce GTX Titan	www.nvidia.com	**$1,000**
RAM	2x 8GB Vengeance	www.corsair.com	**$100**
SSD	256GB OCZ Vector	www.ocz.com	**$250**
Hard Drive	2TB WD Caviar Black	www.wdc.com	**$150**
OS	Windows 7 64-bit OEM	www.microsoft.com	**$100**
Optical Drive	Samsung SN-208DB/BEBE	www.samsung.com	**$22**
Total			**$2,407**

1

ITX-CELLENT

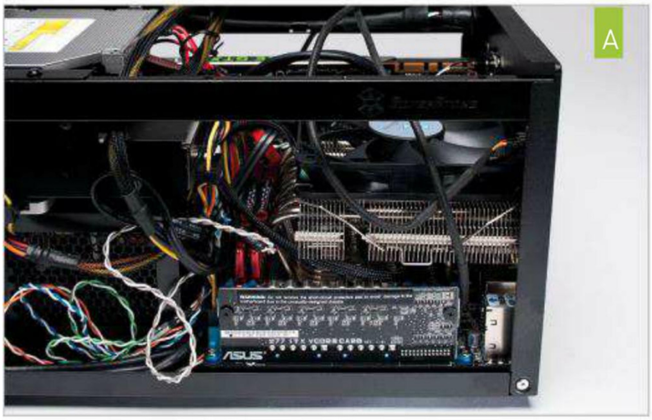
AN ASUS P8Z77-I Deluxe is an expensive board, but you are reading *Maximum PC*, after all. The mobo is loaded with beefy overclocking options, built-in Wi-Fi, USB 3.0 front-panel connectors, and eSATA; it's just as full-featured as mobos twice its size. Asus manages this feat partly because it added an extension called a "riser," which holds extra capacitors and other circuitry, effectively extending the board's size vertically (image A).

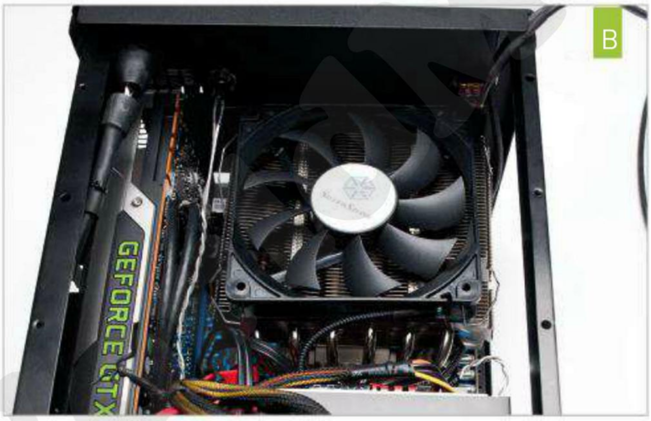
We installed the CPU cooler's backplate before installing the motherboard, as the case has no opening behind the motherboard. The heatsink on the north bridge also has a plastic fastener that we needed to push up a little, to make the CPU backplate fit securely against the motherboard. The board's riser card also has two screws that need to be removed, then re-installed after the motherboard is inside.

2

COOL CUSTOMERS

CPU COOLERS like Silverstone's NT06-Pro are designed for use in chassis like this, where the power supply is not installed over the motherboard, leaving a bit of room over the CPU for some additional cooling power. This heatsink is oriented parallel to the CPU instead of sticking up like a tower cooler, so it fits into tight spots where tower coolers won't. To make the NT06-Pro fit, we initially pointed the tips of its heat pipes towards the PCIe slot, but they were actually blocking it slightly, so we adjusted them to face the rear of the case (image B). The CPU fan went on top, blowing air down through the heatsink and complementing the positive pressure airflow from the 18cm case fan right above it. Installation was simple and took only 10 minutes, which included adjusting the orientation of the heatsink. We could have flipped the case fan and used it as an exhaust instead (ideally flipping the CPU fan as well), but this creates "negative" pressure (a slight vacuum), which usually leads to higher temps.





3

GODLIKE PROCESSING UNIT

NVIDIA'S GEFORCE GTX Titan is basically the star of the show here. The SG08 case can technically fit a GeForce GTX 690, which costs the same as the Titan while outperforming it by as much as 20 percent. But dual GPUs means SLI, and that can be glitchy, which is why people prefer single-GPU gaming. The 690 is also noticeably louder under load than the Titan, and it produces substantially more heat.

To install the video card, we could have gone in from the top or the side. But we chose to go in from the side, at an angle, in order to make sure no cables got trapped below the card. And because the Titan is just 10.5 inches long in a case that can handle 12.2 inches, there was space between the end of the card and the front of the case to hide the power supply cables (**image C**).

4

DRIVE ME CRAZY

THE 256GB OCZ Vector is our SSD of choice this time. You could save money with a Corsair Neutron GTX, but the price difference is tiny against the system's overall price tag. In our tests, the Samsung 840 Pro is a smidgen faster than the Vector, but it's close enough that the subjective difference between the two is nonexistent. The SG08's drive cage leaves just enough room to slip two SSDs under the hard drive (**image D**), though we felt compelled to put the Vector in upside-down to orient its SATA cable more comfortably.

A 2TB Western Digital Caviar Black was also installed to give us much-needed capacity. The drive cage is not toolless however, so a screwdriver is required for installation. Also, the Silverstone SG08 can only fit a "slim" optical drive (normally seen in laptops), but the Samsung was only $22. It needs a special combined power and data connector cable, which Newegg had for a few bucks.

5

DOWN TO THE WIRING

THE SG08'S BUNDLED 600-watt power supply has shortened cables that are specifically designed for the case (**image E**), so that made our job a little easier. It also has just one Molex cable, and one SATA power cable with three connectors on it, so you can only connect up to four devices. The Titan was a bit of a tight fit, but it was OK, and we had enough space to tuck the power cables away. Still, it's difficult to picture an 11-inch video card fitting inside this case, let alone a 12-incher. While the motherboard power cables are braided, the 24-pin cable is still thick and therefore stiff. It and the 8-pin power cable ended up getting looped a couple of times within the spare real estate we had left. The GPU power cables were unavoidably snug against the top of the SG08 when the case cover went on, though; flat cables would be ideal.

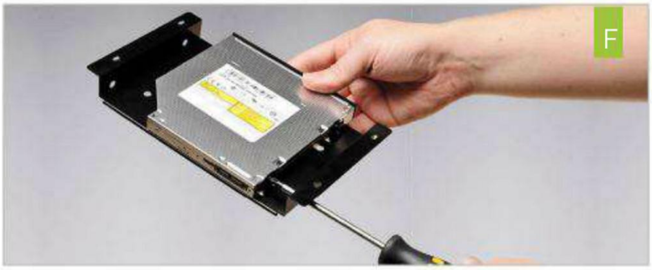
If anything, the biggest wiring problem we faced was with the three SATA cables we used, since they were all standard length. If we had planned better, we would have ordered some shorter cables to help reduce the clutter.

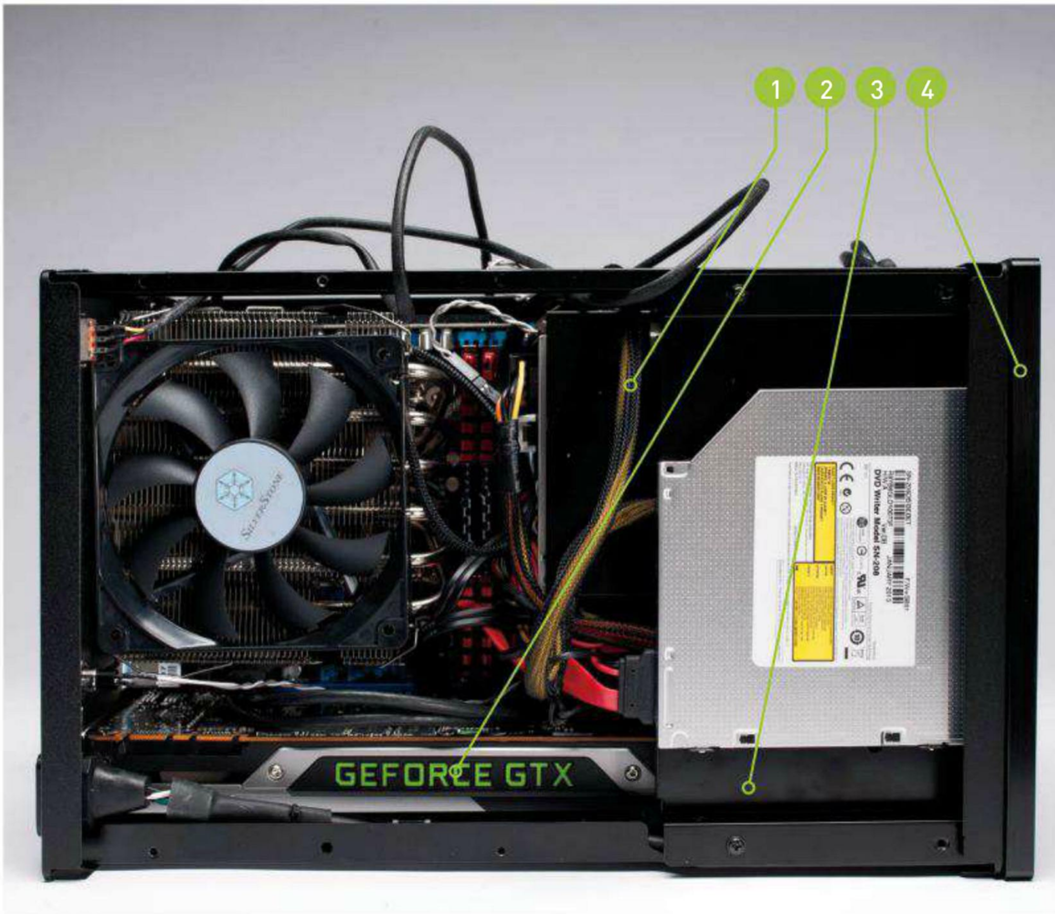
6

MISCELLANY

ASSEMBLING THIS build in the order dictated by the layering of components was a challenge. The GPU definitely had to go in last, because the motherboard's riser card obstructs access from the other side of the case. So, once the GPU is in it blocks access to the rest of the motherboard. If we had forgotten to plug in a cable somewhere, we would have had to pull out the GPU to solve the mystery, so it was important to be methodical.

We had to get a little creative with the cabling to get everything to fit. For example, the SSD and its right-angle SATA connector ended up going in upside-down because we were running out of room to thread the cable around the power supply. We went over the PSU instead, as there were several millimeters of space between it and the optical drive tray above. The optical drive also uses very tiny screws (**image F**), about the size that you'd see on a pair of eyeglasses. The SG08 comes with them, thankfully, but they took a while to insert because the drive tray is recessed (though it uses precut holes for you to align the screwdriver with the screw holes).





1. The included Silverstone power supply pushes 600 watts and has a reduced number of cables that are also custom-cut to fit perfectly inside a smaller chassis.

2. At 10.5 inches long, the GeForce GTX Titan fits just fine and leaves a little space to run cables in front of it.

3. The Sugo SG08's power supply is located in the front instead of the back, which opens up space for a large aftermarket CPU cooler—an impressive feat given its Mini-ITX form factor.

4. The front bezel of the case is designed for a "slim" optical drive, like the ones normally used in laptops.

THE LITTLE OVERACHIEVER IN ACTION

WITH OUR MINI-RIG assembled, cooled, and ready to rumble, we were primed to see how hard we could push these components. After all, the SG08 sports a large grill on the side, offering our GPU the chance to pull in cool air, so the Titan has some room to breathe. The case's unusually large 18cm "penetrator" fan blows directly down on the core of the system at up to 1,200rpm, and the CPU has a big heatsink with a 12cm fan that can go up to about 2,200rpm, so we figured cooling wouldn't be an issue. To our delight, the GPU handled a core overclock of 150MHz and a memory OC of 400MHz without complaints. The Titan did get up to 81 degrees C in our temperature-controlled Lab, which hovers around 20 C (or about 70 F), but Nvidia has told us the Titan is fine up to temps below 95 C. The Titan stayed fairly quiet and pushed almost all of its heat out of the system, too, which was excellent. So as far as the question of a Titan being able to survive in a SFF chassis goes, we'd say it works like a charm, and we can't see it causing any issues at all in other small cases.

You're probably surprised to see that this system's 3DM11 score of 5,571 was within 5 percent of our zero-point system, which boasts a hexa-core i7-3930K overclocked to 4.2GHz and a GTX 690. However, the 690 was not overclocked, and keep in mind the zero-point's GPU scores were achieved with the drivers that were out when it was built in March 2012, so much of the surprisingly small gap is probably thanks to Nvidia's constant software optimizations made since then.

The CPU was a trickier affair. Once you get beyond about 4.4GHz, Ivy Bridge CPUs start heating up dramatically. Taking it to 4.6GHz or even 4.5GHz gave us temperatures we didn't think would be sustainable outside of our air-conditioned testing environment. The NT06's bundled fan is also not particularly quiet once it revs up to about 2,200rpm, and the case fan adds noticeable noise when switched to "high." Even though we thought this little rig might be able to sit in our living room *and* stay quiet while gaming, we're left to conclude this particular setup would not be the best choice.

So, the overall system performance was excellent, the build quality of the case was great (though the bundled PSU could use shorter motherboard power cables), the motherboard handled our CPU overclock quite well, and we didn't have to do anything questionable or dangerous to fit everything into the SG08. Overall, we'd say the mission was accomplished. Now, to build a Titan SLI SFF rig.... ⏻

BENCHMARKS

	ZERO POINT	
Premiere Pro CS6 (sec)	2,000	2,700 (-26%)
Stitch.Efx 2.0 (sec)	831	768
3DMark11 Extreme	5,847	5,571 (-4.8%)
x264 HD 5.0 (fps)	21.1	16.95 (-19.7%)
ProShow Producer 5.0 (sec)	1,446	1,336
Batman: Arkam City (fps)	76	80
		0% 10% 20% 30% 40% 50% 60% 70% 80% 90% 100%

Our current desktop test bed consists of a hexa-core 3.2GHz Core i7-3930K @ 3.8GHz, 8GB of Corsair DDR3/1600, on an Asus Sabertooth X79 motherboard. We are running a GeForce GTX 690, an OCZ Vertex 3 SSD, and 64-bit Windows 7 Professional.

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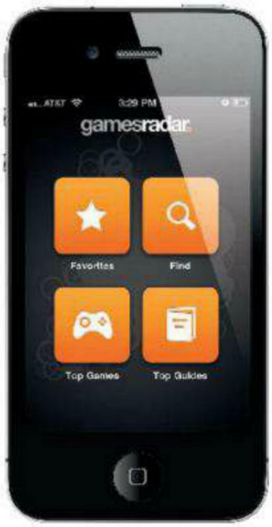
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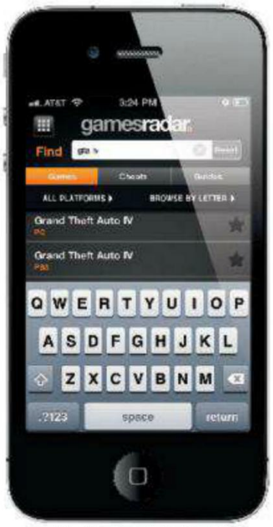
ACCESS TO GR'S
FULL DATABASE
OF CHEATS!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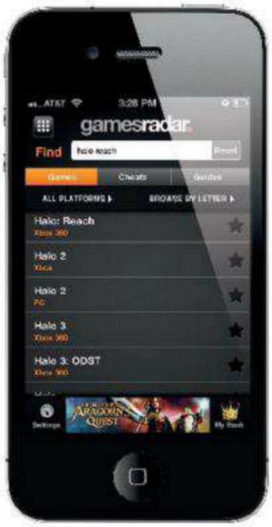
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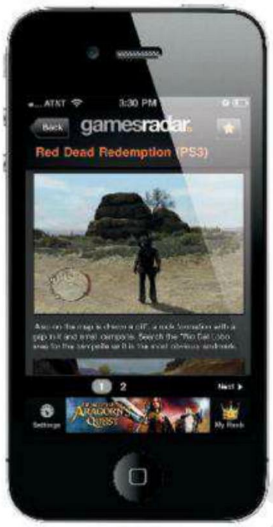
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BUILD IT

JOSH NOREM **SENIOR EDITOR**

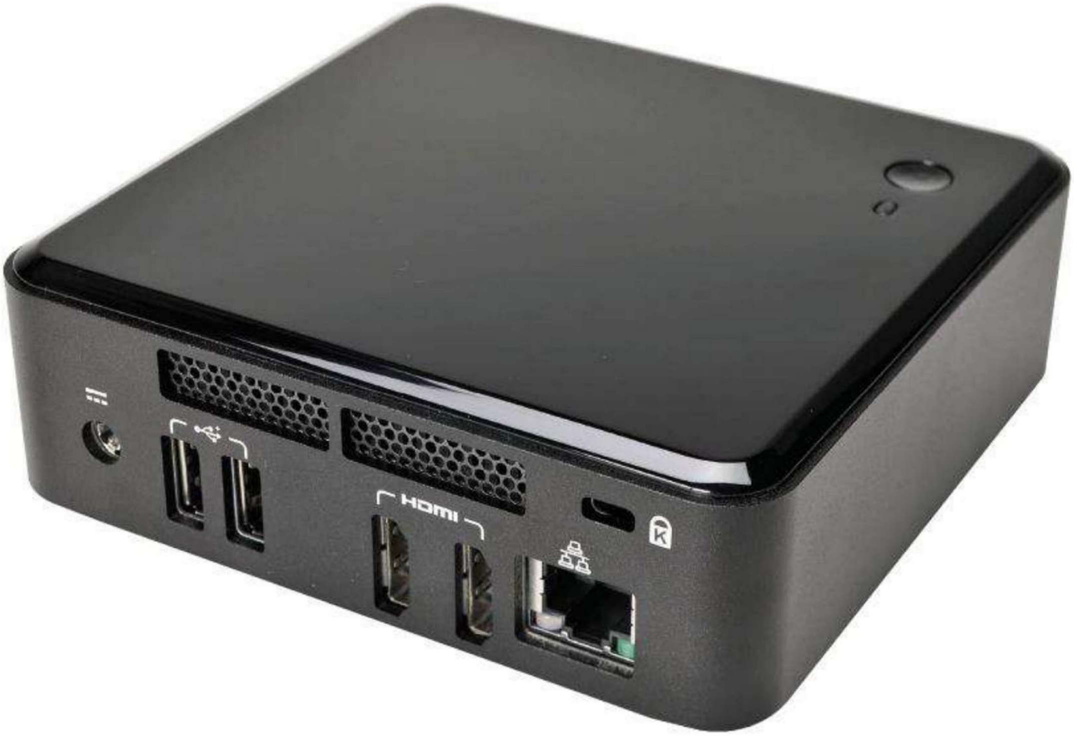
Intel's Next Unit of Computing

Intel's NUC is a pint-size DIY project straight from the labs of Chipzilla itself, so we dove in to see what's needed, how it runs, and whether you should even bother with it

LENGTH OF TIME: **1 HOUR**

LEVEL OF DIFFICULTY: **EASY**

THE MISSION This month's Build It is a bit of a reach for us here at *Maximum PC*, simply because we're used to building PCs that are powerful enough to require an intervention from the local overclocking support group. However, we can't ignore the rise of the small PC, or the living room PC, or whatever you want to call these Lilliputian rigs that are suddenly as popular as raging against the OS hate crime named Windows 8. This little machine in particular, the Intel NUC, which stands for Next Unit of Computing, seemingly came about as a reaction to the surprisingly popular Raspberry Pi, which is a tiny bare-bones PC that originated in the UK early last year and sells for just $25. Though the Raspberry Pi was designed to be an affordable gateway drug into the world of command-line hacking, the Intel NUC is a much more complete solution that Intel says is perfect for home entertainment, commercial kiosks, or just quiet, affordable computing. Since the NUC (pronounced Nuck, though we like to call it the Nuke) doesn't include all the bits that you need to make it run, we figured it was a prime candidate for a Build It article.



NUCTURAL SELECTION

THE FIRST STAGE of NUC acquisition involves deciding which NUC to purchase—there are two different SKUs available as of press time. Both have the same basic specs for storage, RAM, and wireless, in that they have none, so you'll have to BYO. They both feature the same 1.8GHz Core i3-3217U Ivy Bridge dual-core Hyper-Threaded CPU soldered to the motherboard, which won't accept a skyscraper heatsink for overclocking, sadly; and both also have three USB 2.0 ports. They then diverge, with one featuring dual HDMI ports for multi-display action, Wi-Fi, and Gigabit Ethernet, and the other sporting one HDMI port, Wi-Fi, and a Thunderbolt port. The dual-HDMI unit features an all-black chassis and will set you back $290, while the T-bolt version goes for $310 and sports a Corvette-like cherry-red roof. There are also two more NUCs coming soon: a high-end NUC with a Core i5 processor and USB 3.0, and a low-end NUC with a Celeron/Atom processor. For this build, we chose the dual-HDMI NUC (model DC32171YE) because we wanted to use it as a quiet, out-of-the-way PC instead of a typical streaming-media-center box. Its core components include two SO-DIMM slots, an mSATA slot for an SSD, a wireless PCI Express port, three USB 2.0 ports, Gigabit Ethernet, and two HDMI ports. Audio is provided by the HDMI or Thunderbolt ports, but you can't connect your speakers to the NUC. There's also a power brick (but oddly no cable that plugs into the wall) and a VESA mounting bracket included. The NUC includes a 3-year warranty and a box that plays the Intel commercial jingle when you open it.

INGREDIENTS

	PART	URL	PRICE
Case	Intel NUC	www.intel.com	**$290**
SSD	Intel 525 Series 240GB	www.Intel.com	**$300**
CPU	Intel Core i3-3217u	www.intel.com	**N/A**
GPU	Intel HD4000	www.intel.com	**N/A**
RAM	2x 8GB Patriot DDR3/ 1,333 SO-DIMMs	www.patriotmemory.com	**$82**
Wireless	Intel Centrino 6235 80211.n Mini PCIe	www.intel.com	**$32**
Power	AC Power Cord	www.amazon.com	**$1**
OS	Windows 7 Home Premium 64-Bit OEM	www.microsoft.com	**$100**
Total			**$805**

1

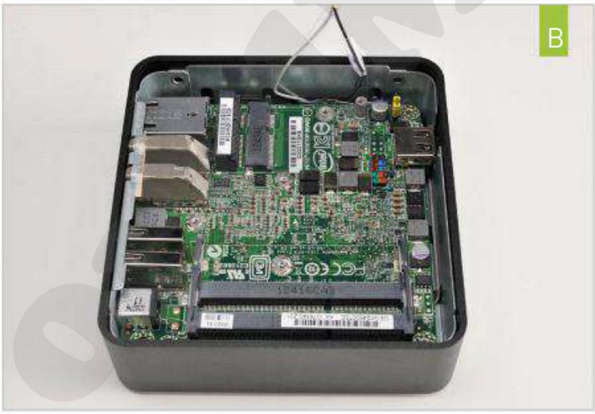
OPEN THE CASE

IN ORDER to gain access to the NUC's innards, you'll need to remove the bottom panel from the device, which thankfully is quite easy. Since Intel figures you probably won't be popping open the chassis very often to swap out parts, it's gone ahead and secured it with four easy-to-remove Phillips head screws (**image A**). The screws are all captured, too, so you don't have to worry about losing them once you pop off the NUC's ventilated door. With the door removed, we see there's also a way to remove the motherboard from the chassis by removing three more small screws. Though putting a door on the little bugger isn't a big deal, it's appreciated since Intel could have theoretically made the NUC a closed system in an attempt to reduce support calls.

2

LET'S HAVE A LOOK AROUND

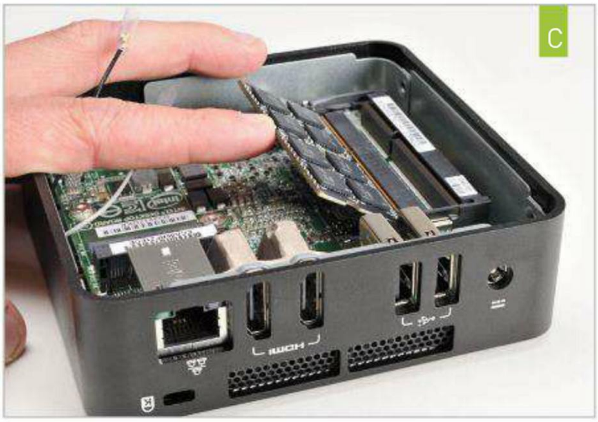
WITH ITS DOME removed we can finally have a look around the NUC to see where everything goes. As you can probably tell, this is the belly of the little beast, or the underside of the mainboard (**image B**), as the Core i3 processor and heatsink/fan assembly are on the other side of the board where active cooling is required to keep things chilly. Down here in passive-cooling land we have a half-length mini PCI Express slot for the wireless card, the full-length mini PCI Express slot for the mSATA drive, two SO-DIMM RAM slots, and one empty header labeled Front Panel. You can't see them but there are Wi-Fi antennae encircling the enclosure; you can see where they attach to the Wireless card. The tiny little mobo rests inside what looks like a crude metal soap dish, though the Intel Desktop Board logo is proudly displayed. We have heard that despite Intel's plans to get out of the motherboard game after Haswell, it does have a roadmap for the NUC, so plan on seeing several more iterations of this bambino rig in the months to come.



3

RAM THE RAM

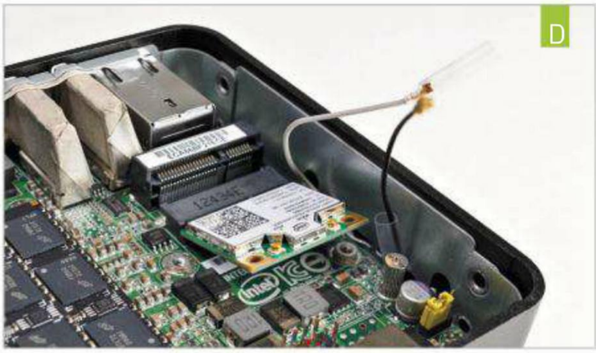
THE NUC INCLUDES two SO-DIMM slots, so you'll need to acquire some laptop RAM, or as our Patriot Memory was labeled, "Ultrabook" RAM. We snagged two 8GB SO-DIMMs of Patriot DDR3 PC3-10600 memory, which run at 1,333MHz. We could have gone with 1,600MHz RAM, but we've had some weird experiences previously with overclocked RAM, so for now we're playing it safe. The RAM sticks cost $40 apiece and are a little bit of a splurge for this system's budget, but we threw caution to the wind and maxed out the NUC's memory capacity. Installation is just like it is with a laptop, requiring you to push the DIMMs in at an angle (**image C**), then slowly push them down until they snap into place.


C

4

WIRE UP THE WIRELESS

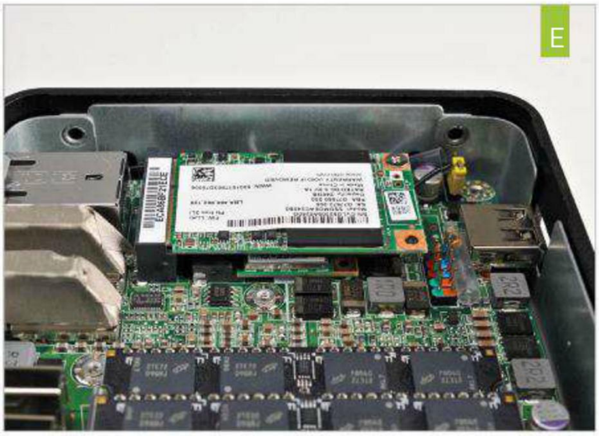
THE NUC SPORTS a form factor known as uCFF, which stands for "ultra-compact form factor." This means it's tiny, so Intel had to stack some components on top of one another like tenants in a high-rise, and two of these tenants are the wireless card and the mSATA card, which sit on top of one another with about a millimeter between them. Due to this arrangement, you must install the wireless card first, which is as easy as sliding the card into the slot (**image D**) and then attaching the antennae that Intel has prewired to the chassis and dropped down right where the card rests. We connected the black lead to the plug labeled Main and the white lead to Aux, but there's no wrong way to do it. We chose a Wireless N card from Intel but any half-size mini PCI Express card will do. The Intel Wireless N card costs $30, and gave us a consistently strong signal in the office.


D

5

SATA-L-UP

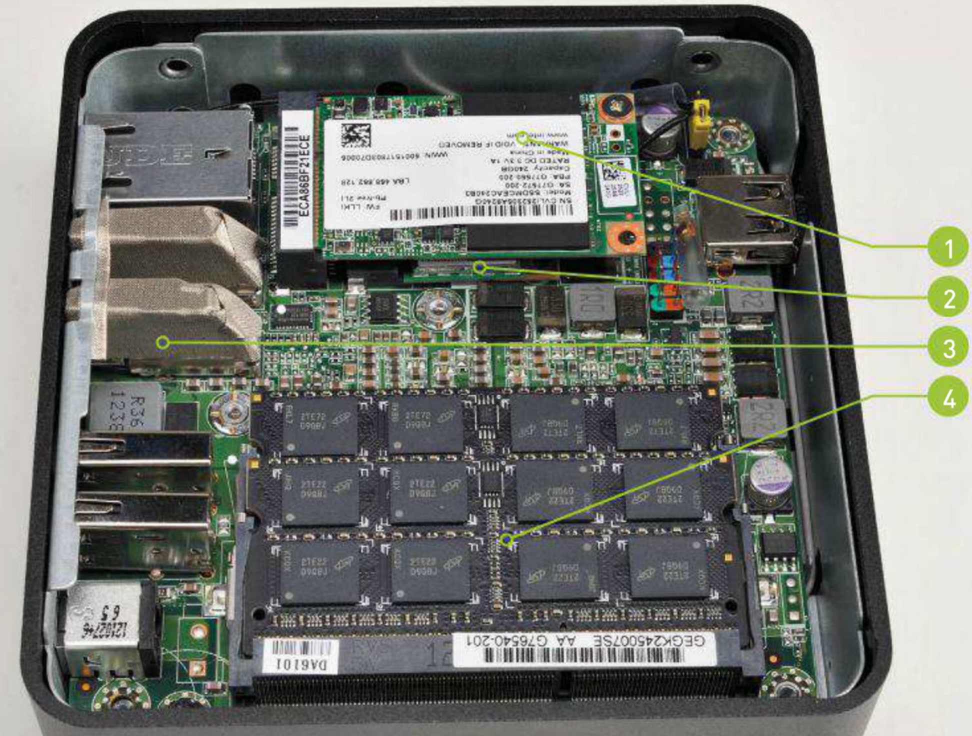
CHOOSING WHICH MSATA SSD you will use in the NUC is arguably the most important decision you and your doctor will make, as it's the only user-upgradeable component that will have a tangible effect on performance. Sadly, modern mSATA SSDs lag behind the blazing-fast 2.5-inch SSDs we all use today, so shopping for one is a bit disconcerting, as names like Samsung, Corsair, and OCZ are nowhere to be found. Instead the choices boil down to Intel, Crucial, Adata, and Mushkin. Since consumers don't typically purchase mSATA SSDs, the pickings are slim. However, the new SandForce SF-2281-powered 525 Series from Intel are a glimmer of hope, as they ride the SATA 6Gb/s interface and are equivalent to the totally fast 520 Series 2.5-inch drives, so we went with the fat 240GB version. To install the drive we simply inserted it into the keyed slot and then secured it using the provided screw (**image E**). And yes, we know this is an expensive SSD, so please don't write us letters saying we spent too much on the drive. This is really just a way to get a good look at what the NUC can do, and a 120GB SSD should offer similar performance.


E

6

INSTALL THE OS

WE USED A USB optical drive to install our OS. We then went to the Intel website and loaded the wireless and Intel QS77 chipset drivers onto a USB key in order to get them onto the NUC. Once that was accomplished, we were good to go. All in all, we had the OS installed to our Intel SSD in roughly 10 minutes, and after Windows Update ran a zillion times and rebooted even more, we were finally up and running within an hour (SP2 please, Microsoft). The first thing we did was to run the Windows Experience Index test, which showed us a score of 5.9—pretty dang good for a munchkin rig like this. To put it in context, the AMD Brazos–based Zotac Zbox Nano XS scored just 3.9 in the same measurement.



1. The mSATA drive and wireless card are stacked so tightly that the Thunderbolt NUC will overheat in certain configurations, but we experienced no issues with our dual-HDMI unit.

2. The Wi-Fi antennas that are usually wrapped around a laptop's LCD bezel are strung around the NUC's chassis for improved reception, and attach to a Wi-Fi card nestled beneath the SSD.

3. The all-black version of the NUC features two HDMI ports, while the red-roofed model has a Thunderbolt port. Neither model has USB 3.0 (sad emoticon).

4. On the other side of the mobo (beneath the RAM shown here), lies a Core i3 CPU that's permanently attached and cooled by a heatsink/fan combo that stays extremely hush-hush.

THE NUC IN THE REAL WORLD, OVERHEATING, AND CONCLUSIONS

WE WERE pleasantly surprised by the NUC, mostly because we've always had a "size matters" mantra in our heads that subliminally controls our expectations about a PC's performance. Given the NUC's small size, and our experience with other pocket PCs like the Raspberry Pi and the Zotac Zbox, we expected the NUC to largely *suck* from a performance point of view. But it didn't. For web browsing, watching movies, and running MS Office it felt just as fast and responsive as any other PC we've used lately. Though you're probably inclined to think its speedy nature is partly due to the Intel 525 Series SSD, we also tried it with a garden-variety Intel 310 SSD, and that felt quite responsive, too.

Since the NUC includes decent onboard graphics care of the Core i3 processor, we fired up Far Cry 3 and Portal 2 to see whether either was playable. Sure enough, the NUC had some major issues with Far Cry 3, but was able to just barely play Portal 2 at native 1080p resolution with all settings on Medium. For kicks, we ran 3DMark 11, and the NUC scored P581. So, gamers need lowered expectations. Media streaming, however, is great. Among the media files we tried on the NUC was a 10GB HD rip of *Avatar*, which ran on the NUC flawlessly. The same file brought the AMD Brazos–equipped Zotac to its knees. The playback stresses the CPU and GPU quite a bit, not to mention the SSD, so we were seriously impressed by its ability to smoothly play such a massive file.

Now, for the bad news: We played around with the Thunderbolt version of the NUC and it overheated in testing. Initially, we suspected faulty RAM since RAM can cause random shutdowns, but when we took the top off the NUC we noticed that the SSD and wireless card were burning hot, so we threw a fan on it and all problems vanished. Obviously, that's not a good long-term solution, but Intel is aware of the problem and is working to rectify it. Whether that involves redesigning the mobo so there's more room between the PCI Express connectors or upping the fan speed remains unknown.

All in all, the NUC is nifty, if not slightly defanged for its lack of USB 3.0. We love its small size, decent amount of horsepower, and silent operation. We would totally buy this for our moms if the overheating issue is rectified. We'd also wait for Gen 2 of the NUC, as the thought of a Core i5 processor and USB 3.0 sounds like a tasty recipe for a quiet, out-of-the-way PC. ⏻

THE LIST

7 UNSUNG HEROES OF THE PC UNIVERSE

7

12CM CASE FAN

These vigilant guardians have not only kept our PCs cool for a generation, but have done so silently.

6

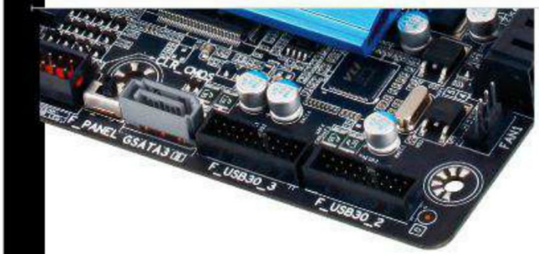
RIGHT-ANGLE SATA CABLE

Before these clever variants existed, SATA cables would bend when the side cover on our case was attached, causing them to pop out of their ports.

5

ZIP TIES

We used to just close our PC side door and hide our cabling shame. With zip ties' help, we can proudly display our rig's tidy guts to the world.



4

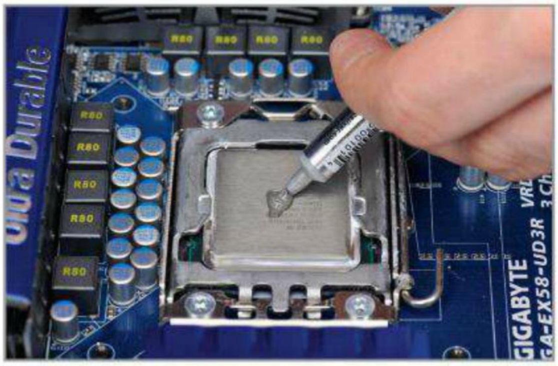
MOTHERBOARD LABELS

Remember the horror of trying to figure out where to plug things in on a mobo? We still have PTSD from the USB connectors.

3

THERMAL PASTE

The parts above and below it get all the glory, but it's the sandwich meat that makes it all possible.



2

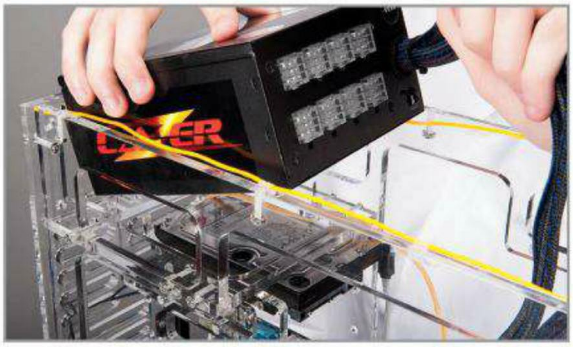
CASES WITH CABLE ROUTING HOLES

Poor Dream Machine 2000; it had to suffer the indignity of a world without cable-routing holes.

1

POWER SUPPLY

It does its job without fuss or noise, and when it's working perfectly you're not even aware of its existence.



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